

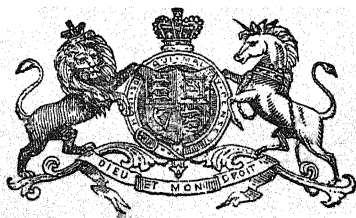
MILITARY TRANSPORT.

BY

LIEUT.-COL. GEORGE ARMAND FURSE,

Deputy Assistant Quartermaster-General.

"War tries the strength of the military framework. It is in peace that the framework itself must be formed."—NAPIER, PENINSULAR WAR.



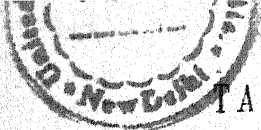
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PREFACE.

THE reports on the late Afghan and Zulu wars have confirmed the often repeated assertion that one of the greatest difficulties of our Military Transport on service lies in the inexperience of the Officers appointed to do duty with it. If circumstances do not permit of our Officers acquiring by a previous training a certain degree of practical experience in Army Transport before the outbreak of hostilities, still it may be conceded that they can familiarize themselves through study with the details of this very important military requirement. With this object in view these pages have been written, and, though no one realizes better than myself both the difficulty of the subject and my inadequacy to deal with it properly, I have not been deterred from publishing the result of my studies, trusting that in time the subject may be ably dealt with by some better qualified Officer.

That the question of military transport is not the most attractive part of the study of the art of war I will readily concede, still it must be admitted that a better knowledge of it than most of us at present possess will be the means of saving the country in a future war many thousands of pounds, and will prove of the greatest assistance to the Officer entrusted with the direction of military operations.

The efficiency of our army transport on service rests on the degree of attention paid to it in peace time. We should not rest satisfied with censuring when a war discloses a sad failure in our transport arrangements, but, in the leisure times of peace which follow it, we should frame on our past experience such an organization as will put the possibility of a failure recurring entirely out of the question.

The compilation of this book has only been possible owing to the information derived from the recorded experience of many able military writers, and it is just to acknowledge that their works have been unsparingly used.

G. A. F.

1st March. 1882.

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CHAPTER I.

DEFINITION—MEANS BY WHICH MILITARY TRANSPORT CAN BE EFFECTED—INTRODUCTION OF STEAM HAS ALTERED THE SYSTEM OF TRANSPORT—RAILWAYS WANTING IN OUR WARS—OTHER DESCRIPTIONS OF TRANSPORT ALWAYS NECESSARY—OUR WARS DIFFER FROM THOSE WAGED IN EUROPE—CAUSES WHICH NECESSITATE A LARGE TRANSPORT—NECESSITY FOR STUDYING THE QUESTION IN TIME OF PEACE—UNDER WHOSE CONTROL SHOULD TRANSPORT BE PLACED—DEMANDS OF THE COMMISSARIAT FOR ITS UNRESTRICTED CONTROL—ARGUMENTS IN FAVOUR OF A TRANSPORT BRANCH DISTINCT FROM THAT OF SUPPLIES—EXPERIENCED OFFICERS NEEDED—ITS MILITARY CONSTITUTION ADVOCATED—FIRST LINE OF TRANSPORT—SECOND LINE OF TRANSPORT.

Military Transport is that part of the military organization which provides for the mobility of an army, for by the aid of military transport alone can an army in the field move at any moment in any required direction complete in all that it needs, both for its subsistence and its efficiency.

De Gerlache, writing on the transport of an army, remarks: "The transport service is one of the most necessary for the success of an army, and often even for its preservation. It is from this service that an army obtains its means of subsistence, all its baggage, all its ammunition, and finally by means of this that it retires without disorder or loss. The transport service is the soul of an army, because alone it gives it life and movement. It is an object which a wise administrator will not lose sight of for one moment, and to which he should devote particular attention, because the success of his operations, and consequently his honour, almost always depend upon it."

Sir J. Adye, in his account of the Sittana War, justly observes: "It cannot be too constantly borne in mind that efficient transport is one element of success."

Military operations are impossible without proper transport, and to place troops in the field without the means necessary for moving them cannot be but a waste of money and power. All military administrators are unanimous in admitting that, in order not to impose too serious a burden on the finances, transport must be kept within reasonable bounds in peace time, to be expanded in war to meet the innumerable requirements of an army in the field; in other words that the expense to the State must be moderate in peace time and not extravagant in war, and that, when the necessity for transport is over, it must be promptly reduced to within reasonable bounds. In this expansion of the military transport in time of war lies the great secret of the whole question.

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Military transport should comply with three essential conditions : it should be sufficient for the wants of the force employed, should be at all times in the best possible condition, and, lastly, always ready for movement. As a rule transport either for the conveyance of the sick and wounded or for supplies and *matériel* has been insufficient in all armies.

An army in the field requires transport for its sick and wounded and for a number of articles, the principal being food, forage, ammunition, entrenching tools, medical comforts and appliances, equipment, baggage, treasure, clothing, telegraph materials, etc., all of which can be conveyed.

- (a.) By means of railways.
- (b.) " " carriages or pack animals on ordinary roads.
- (c.) " " carriers in exceptional cases.
- (d.) " " steamers, sailing vessels, or boats by sea, on rivers, lakes, or canals.

The introduction of steam as a motive power has effected a remarkable change in the general water and land transport of the world. Military transport has benefited by this change, especially by land, where railways are every day more and more utilized for military purposes.

All countries alike have not, however, adopted modern improvements, and, in many, railways either do not exist or are too few in number ; but, even in the best of cases, where these improved means of locomotion are plentiful, an army requires also other means of transport on account of the constant shifting of direction of military operations, the destruction of railway lines by a retiring army, and the necessity for distributing what railways only convey in bulk.

Railways are of invaluable use in transporting men and stores in time of war. They offer the most complete and rapid means for conveying troops, provisions, and war materials ; they facilitate the supply of the daily wants of an army, and thus impart to it considerably increased freedom. On account of the facility with which they can be destroyed or rendered temporarily impracticable, they cannot, however, be used as the only roads of communication and must be employed in conjunction with the ordinary roads of a country. It is owing to their liability to temporary obstruction, to their unalterable direction, and to their number being small, when compared to the ordinary roads, that the importance of these latter as lines of communications has in no way diminished since the introduction of railways.

Transport on ordinary roads can only be effected by the employment principally of carriages and pack animals, and the importance of these means augments in proportion as the distance from the enemy is lessened, until they become the only means of transport that can be safely employed. Rustow, in his *L'Art Militaire au XIX^{me} Siècle*, observes, "Whatever may be the services that railways can render, it is clear that one should not neglect to organize for war the transport of an army, because railways are easily destroyed ; because their employment may be interrupted by the existence of fortified places ; because, lastly, these means of transport are indispensable for the troops when compelled to quit a railway line."

Even operating in countries traversed by railways, our troops will require the first line of transport immediately after landing. But our great difficulty, even with a properly organized transport, will be its conveyance by sea to a distant seat of war, for the conveyance of the

difficulties,* it will be a matter of time to collect even an indifferent one, and nothing can be undertaken until this, unsatisfactory as it may be, has been procured, for the mobilization is not complete without it. In 1854, for want of shipping, only 75 mules and a few Maltese carts were embarked at Varna to accompany the British army to the Crimea; these, and about 350 country carts which were seized after the landing, constituted all the transport the army had to rely upon in advancing on Sebastopol. At the conclusion of the war there was a large and efficient land transport corps, but how many months were needed to collect and organize it? As the army was stationary this became possible, but such would not be the case where an army is in constant movement.† Experience has demonstrated that a military transport should in every case be organized, before the actual commencement of operations, for to organize it, once the work of conveying has actually commenced and which cannot for a moment be interrupted, is practically impossible.

Transport has been the greatest difficulty of all our wars, as also one of the greatest sources of expenditure. In peace time we are always in a state of unreadiness for war, as economy forbids our keeping up a large transport corps. If arrangements for transport could be made leisurely before the outbreak of hostilities, then a sufficient and efficient transport might be raised with economy; but experience shows that the time for preparations is generally insufficient, and when the hour for action arrives, for want of forethought everything has to be done hurriedly; prices rise to an unreasonable extent, and we must rest satisfied with animals and *matériel* of inferior quality, and with officers with little or no experience in transport matters to place in charge of them. Turn to the Abyssinian Expedition, to the late war in Afghanistan,‡ or the one against the Zulus, what time was there for making preparations—two or three months at the most—and is this sufficient to prepare a transport on a very large scale? If transport is forthcoming operations can be commenced at once, there is no unnecessary delay, and consequently much greater economy.

A permanent transport in peace time is a necessity. It is true that, rather than encourage a constant expenditure in keeping transport for many years of peace, there are people who consider it a more economical plan to meet the want of transport by special grants of money when the necessity for it actually occurs; but we do not get then the training the officers require, and the time for procuring and organizing it is too limited. The formation of an efficient transport corps is undoubtedly a question of time.

In continental armies the military or first line of transport is always provided, mobilized with the troops, and ready to commence operations without delay. With a census for animals and wagons, and the rigorous enforcement of the law of requisitions, there is little difficulty in obtaining the additional transport needed. Our position and requirements differ materially from those of continental armies, for we do not

* General Belliard, writing to General Berthier from Madrid (31 July, 1808), complains of the difficulty of procuring transport, as the inhabitants burnt their wheels and drove the draught animals away to avoid rendering assistance to the French troops.

† This was a repetition of the experience of the Peninsular War where the delay in the operations which took place at Torres Vedras, facilitated the improvement of the organization of the transport of the British Army.

‡ On the 3rd August, 1878, the Secretary of State for India acceded to the

merely carry a war across the frontier, but in all parts of the world, and in countries differing greatly from each other. If it be an admitted fact that the success of every campaign depends greatly on the transport of the army that undertakes it, how much more will it be so when we consider the circumstances under which most of our wars are carried out.

Since the close of the Napoleonic wars, the warlike operations in which British troops have been engaged have been principally carried out either against savages, or badly organized armies, in countries generally wanting in good roads, and where the name even of a railway was unknown. Most of these countries were entirely wanting in the means of subsistence necessary for a large force, and in many the climate was injurious to the European soldier; hence a transport had to be formed on a very large scale, and was often raised at a very short notice. In campaigning in unhealthy climates the soldier must be well nourished, clothed, and sheltered, for, if badly fed and insufficiently protected, he is more prone to succumb to the epidemics of the country. In most of these minor wars, the problem to solve was how best to forward sufficient supplies for a certain force to enable it to exist, accomplish its mission, and return with the least possible delay, so as to derive all the advantages of the good season, in which, only, military operations could be carried out without risk. It was purely a question of nicety of arrangements.

These wars are very exceptional in their nature, and in these tactics and strategy are not of so much account as judicious administrative arrangements, for, whilst tactics and strategy need not be of the highest order when the military training of one's adversary is not of a superior class, the difficulties of supply and transport, owing to the barren and unproductive nature of the country, the absence of good roads, and the great wants of a properly organized army, are constant, and do not vary with the skill of the enemy. The result of the fighting, notwithstanding the general inferiority in numbers, need not be apprehended, as it is reasonable to expect it to be favourable to the best organized, disciplined, and armed force. A difficulty was experienced at times in bringing the enemy to an engagement, imbued as he often was with a dread of the superiority of the European, and with a strong reliance in the difficult nature of his own country. A rapid and continuous forward movement is a great element of success in such wars—always to anticipate the enemy who, for want of organization, is generally slow, to follow up an advantage with rapidity, to harass him from place to place, destroy his stores and supplies, and oblige him to break up and disperse for want of food.

Mr. Fox, in his account of the war in New Zealand, justly remarks: "What we had to convince them was, that we were better soldiers, personally, than they were; that our force was irresistible; and that with our superior training and armament, they had no chance of resistance. Short, sharp, and decisive operations were what were wanted, in order to convey to the minds of the natives, not only of those engaged in the conflict, but to those at a distance who sympathized with them, the moral conviction that we were their masters."

These short, sharp, and decisive operations are only possible where a well-organized and sufficient transport is provided. At Umheylya a rapid advance of our troops at first might have prevented the rising of the hill tribes, but we had no proper transport, hence our troops were delayed whilst the numbers of the enemy were gradually augmented. In the Waikato operations in New Zealand, after the skirmish at Kohera on the 17th July 1863, the troops remained for fifteen weeks without

making a forward movement, notwithstanding that the enemy's advanced posts were only three miles off. For, though for the previous two years a war in that district had been considered by all as almost inevitable, proper means of transport had not been provided beforehand. Again, in Ashantee, for want of sufficient transport, our movements were slow. Had our small army been able to push on to the capital immediately after the arrival on the Prae of the envoy from Coomassie, there might have been no fighting at all, and the King, unable to assemble his men in time, would have no doubt agreed to the terms proposed by Sir Garnet Wolseley before he attacked his army at Amoafu.

Our political obligations, the safety of our colonial possessions, and, above all, our relations with many of our neighbouring States in the East, make it always uncertain at what particular moment we may be called upon to place an army in the field; hence it is more incumbent on us than on any other military power to direct our attention to the organization of the transport service, a service which bears great influence on the progress and results of all warlike expeditions. All officers acquainted with our military history cannot fail to have remarked the continual recurrence of our small wars and expeditions. These demand a special education for our officers, and an organization suitable for rapid operations by small numbers of troops, principally in uncivilized countries. Here the transport becomes a point demanding particular attention, for we should bear in mind that in most of these expeditions we move the best fed and cared-for troops in Europe, in countries far from home, in trying climates, over bad roads, and through unproductive districts. Much that is written on the art of war applies principally to European warfare, where armies pretty well balanced in point of numbers, moving in a civilized country, and following the same principles of instruction, organization, and discipline are opposed to each other; our military education requires, however, a somewhat different training, as our military expeditions and wars vary considerably from civilized warfare, and the difficulties we have to contend with do not, as a rule, occur in European wars. We much need a practical school in which military administration can be studied by a large number of officers, in which a fair knowledge of our system, organization and wants may be obtained, and in which the teaching should be as practical as possible, suited more to the irregular warfare in which we so often engage than to the scientific warfare carried out in Europe.

The requirements of an army making long marches through a difficult and poor country can only be ascertained by personal observation, by collecting information from military despatches and departmental reports (which are not open to every one alike), and by a careful study of the narratives of our previous expeditions and wars. Even these last are generally wanting in certain interesting details which would only prove tedious to the general reader. As a rule military historians have left little on record regarding the details of the transport arrangements made by armies in all ages, military writers having selected for their *spécialité* the study of the more brilliant branches of military science to the detriment of a much less attractive, though equally momentous one. The passages relating to the transport service and other matters of administration are few, and being scattered throughout the books require much time and patience to collect.

The raising of a transport corps at a short notice (for in many of the countries in which we may have to make war an entirely new corps will have to be raised) will always be a difficult undertaking, but much of the difficulty may be overcome by an attentive study of our

former wars and expeditions, which show how, by adopting a certain organization, and following certain fixed principles and rules, we may hope to guard against the break-down of our transport, such as has occurred in many of our past military undertakings. It is only by judiciously applied experience that we may hope to secure the best results. The want of clear rules for the organization and management of army transport causes great loss of life amongst transport animals, is a waste of money, and endangers the success of military operations. We cannot plead want of experience, for the British army has had a greater share than any other army in these difficult undertakings, and has had many sad lessons from the bad results of a hastily and insufficiently organized transport. All the bitter lessons which have been taught us, at a great cost, have been allowed to be forgotten in the periods of peace which have followed each war, instead of being worked up as they should have been to form a ready basis for guidance on service. This fact has been repeatedly recognized, amongst other instances, in the letter appointing Lord Strathnairn's Committee to inquire into the Supply and Transport, the then Secretary of State for War says: "The arrangements to be made for executing the transport service of an army is a question of such magnitude and importance as to render it most desirable that it should be fully and carefully considered, in order that with the increased experience which has been gained on the subject both in China and New Zealand, such measures should be determined on in time of peace as will prevent the uncertainty and confusion which would arise on the outbreak of war, if the system to be adopted had then to be settled." This letter bears date 29th June, 1866, still, many years after, in the late campaigns in South Africa and Afghanistan, no marked improvement was apparent. This we conceive arose from the fact that when a break-down of the transport has occurred in our wars, however loud the censure may be at the time, no real steps are taken to remedy the faults committed, or apparent shortcomings, whereas we should not rest satisfied simply with finding fault, but should take such measures as will thoroughly prevent the possibility of their recurring on a future occasion. This is more than ever necessary as transport in time of peace is kept up in such a limited quantity that the difficulties of working it on a large scale are not then experienced.

Where transport by road, rail, sea, canals, etc., have been the means of adding so much to the commercial wealth of our country it appears strange that our military transport should be always found wanting in our wars. An efficient transport is so essential for the ulterior result of all military operations, whether on a large or small scale, that no pains should be spared to ensure this essential element of success to every commander. We should not neglect in time of peace to prepare for the exigencies of war in such a difficult requisite. To organize it so as to obtain a systematic performance of the duties required a certain time is indispensable, and, as the short duration of modern wars abbreviates the necessary time for preparations, there is greater need for suitable preparations in time of peace.

A failure in war, if brought about by the insufficiency and inefficiency of the transport, will bring discredit to a military commander, though the blame should fall by rights on those to whom this service has been entrusted in time of peace, who should then not merely strive to work it economically, but who should look a-head and devise such an organization as will meet both the requirements of the normal service and of the more extended operations of the Transport Corps in the field.

In a matter of such vital importance as army transport, on which so much depends in actual war, the vexed point as to whether it should

form a separate department of itself, or be a branch of the Commissariat, demands serious attention. This is a question of particular importance, on which a good deal of the efficiency of the transport will mainly depend. The demands of the Commissariat Department for the entire and independent management of this service may be summarised as follows :—

The Commissariat being the great contracting party of the military service and having charge of the funds of the army, is better fitted than any other to effect the extensive operations of providing the means of transport, and accounting for the funds thus expended.

The Commissary-General or other officer who may be responsible for the feeding of the troops should have unrestricted control of all transport.

It is practically wrong for the Commissariat to depend upon any separate branch for its transport. The whole means of collection, custody, and delivery of supplies should be centred in one and the same department. The Commissariat requires the largest portion of the whole transport of the army, hence this department would have most interest in its completeness and sufficiency. It requires, besides, absolute regularity and punctuality in the service, as supplies of food and forage are indispensable conditions of military success.

The amount of transport for Commissariat service is an unknown quantity, all other transport can be easily calculated. Wherever there is a Commissariat Officer he must be alive to the chances to be profited by, and failures to be provided against, and unless he has a Transport Officer for his shadow, the opportunities for either must be lost.

Transport detailed for other than Commissariat purposes would be inactive for long periods together, but if placed under its control, the Commissariat would provide transport for any but Commissariat duties when required, at other times using it for its own requirements, thus causing economy of transport.

A military organization of the transport might in practice be prejudicial to the authority of the Commissariat Officer in his own department, as, on an emergency, military officers have shown a decided preference to comply with military demands to the detriment of those of the Commissariat. Hence this department refuses to take the responsibility of any failure in the supply, unless entrusted with the unrestricted charge of the transport.

A careful examination of the whole question, based on the experience lately gained in the Afghan and Zulu wars, has made it clear that the burdening of one department with twofold duties can only be conducive to good results where the two branches, though administered conjointly, have separate executive duties to attend to. In other words, that there will be less chance of failure in important arrangements where the two branches, supplies and transport, are united under one control, provided that at all times the duties of each branch are kept clearly distinct; the officers of the first attending solely to matters of supply, those of the second confining themselves purely to the work of conveying; the same officers not having to attend to both duties, and carefully abstaining from interfering in controlling the branch they do not actually belong to. In peace time there is no gainsaying that the transport, very limited in quantity, can be economically managed as a branch of the Supply Department; and if the above separation of the two branches is strictly maintained, there can be no reason for forming a separate Transport Department on the outbreak of hostilities.

There is no denying that supplies and transport are intimately connected, for what would be the use of accumulating vast quantities of supplies if these could not be brought within reach of the people who have to consume them. The duties, however, of the two

branches, supplies and transport, are so thoroughly different; one requiring thorough business habits, experience in financial transactions, knowledge of the needs of an army in all situations, acquaintance with office details, book keeping, correspondence, etc.; the other attention to routine duties and training to command, that men with a distinct education are required for each. The nature of transport duties, which include the daily supervision of an immense establishment of men, animals, and materials; the maintenance of its organization through the many difficulties which are sure to be constantly arising during active service; the training, keeping at work, and replacing of thousands of animals; the keeping up of different establishments necessary on account of the variety of animals used for transport; the daily routine of duty, inspection, instruction, payments, rationing, etc., of thousands of attendants, often of different nationalities and at times not of the best character; the constant repairs of harness, saddlery, wagons, etc.; in short, the supervision of all these onerous duties can be best effected by placing this service in the hands of officers unfettered by any other duties whatsoever. Then only can the proper amount of attention and supervision, on which this service mainly depends, be obtained. The extra care the transport requires to limit the number of sick and inefficient animals and useless materials, demands constant attention, on the part of all its officers, to a quantity of petty details, which cannot be attended to if controlled by officers who have in addition another difficult service to devote their time to, and in the furtherance of which the vital importance of the efficiency of the transport means may be overlooked. The unity of the two branches under one administrative head will present fewer difficulties, will cause less friction, will reduce correspondence, will facilitate the handing over of supplies to the branch that has to carry them and their delivery to the supply officers on arrival at destination, and will check differences of opinion as to the amount of transport actually necessary on demands being made for the same. The responsible officer controlling the two is answerable that what is most required is duly transported, for which purpose the means are placed at his disposal.

The Right Hon. Sir J. McNeill, in his evidence before the Select Committee on Military Reorganization of 1860, stated: "... "I have come to the conclusion, that for the management of the supplies and transport of your army, you require some officer who shall be constantly at Head-quarters, a man of military rank, selected specially for the purpose, who, when he receives the orders of your Commander of the forces for any operation to be carried out by the Commissariat, shall be responsible for their being carried out." The Inspector-General of the Line of Communications would evidently be the officer recommended by Sir John, and, though not at Head-quarters, he would be in telegraphic communication with the Commander of the forces. It may be observed that in the days in which the above Select Committee sat the communication service had not assumed all the importance it has now; it had not then a thoroughly distinct organization, for, in fact, it may be said that it was never fully reduced to a system until the outbreak of the Franco-German War of 1870.

We borrow the following from a small pamphlet by A. Baratier, *Sous-Intendant Militaire*: "*La Vérité sur l'Unification des différents Services de Transport*," to show how this question of the separation of the two branches is explained in the French Service:—"The organization decrees of the 29th February, 1852, and of the 11th June, 1853, make a distinction in the service of the transport train between command and employment. With regard to command, the transport

train has its personal independent existence like every other corps of the army. The *Administration* has nothing to say to the organization of these troops, interior economy, discipline, punishments, rewards, or changes of *personnel*, any more than to offer advice regarding the management of the carriages or the park. Thus, under this head, the transport train is legally constituted as a really autonomous corps, depending essentially upon its own command, and having no further relation with the *Intendance* but what is needed for its interior administration; the same as all the other corps of the army." After showing the difference between the normal and the exceptional service of the corps, this officer adds: "The officers of the *Intendance* have repressive authority over the *personnel* of the train, but only for the execution of the normal service and whilst this lasts." Further on he concludes with these words: "Thus, to resume, and giving the words 'to command' all the acceptance which is generally attributed to them in military parlance, it is correct to say that the *Intendance Militaire* does not command the transport train; that she only makes use of it, and that her authority is limited to the employment of the means of action which that arm possesses." These words contain the foundation of the link which exists between supply and transport in the French army, and though this organization is peculiar, still experience has shown that it can be maintained without the service suffering in any way thereby.

The Commissariat not having sufficient officers to look after both supply and transport duties has always to borrow a large number of combatant officers for the latter on service. Experience has shown, and continues to show, that the *personnel* of the Commissariat both at home and in India is insufficient to look after both the supply and transport in the field. Colonel Mignon, Commissary-General of the Bombay Army, a strong advocate for placing the transport in charge of the Commissariat, frankly admits that the Commissariat establishment of the Bombay army is kept so low that it is barely sufficient for the current garrison duties in peace time. Without looking further back, the two last wars of ours clearly show that the bulk of the Transport Officers for our armies in Afghanistan and Zululand was borrowed from the Line, whilst other officers were drawn from the same source to assist the Commissariat in supply duties.

"A really capable Commissariat Officer," Sir Randolph Routh tells us, "must be a complete man of business. The purchases, negotiations, and transactions of different descriptions which he has to conduct by land and sea with persons of every nation and character call into action the most varied attainments and powers of mind." It is unadvisable to employ in the transport these men who, by long training in time of peace, have been formed into complete men of business, as long as combatant officers trained to command and enforce order, punctuality, and obedience can be obtained. The latter are, besides, more numerous and more easily spared, which counts for a good deal. The difficulties of the supply service of themselves alone are immense, hence we cannot burden the supply officers with another difficult service for which it is possible to utilize officers who possess no special qualifications for purely commissariat duties. The Commissariat transport in the late Afghan War broke down, amongst other reasons, owing to the excessive burden thrown on the Commissariat officers. Amongst other causes affecting the failure of the Commissariat in the Crimea was advanced the reduction of the department from motives of economy. Is the Commissariat of such strength now, looking at the size of the armies placed in the field, as would enable it to meet the requirements of a large European war, both in the supply and trans-

port branches, without demanding personal assistance from the rest of the service?

The system of victualling entirely from the base, the only possible one in our small wars, is no school for the large supply operations of European warfare. In this, the Commissariat Officers would be few when compared to the large number of troops employed, and not in the same ratio as when few troops take the field in our small wars; they would have to work under an entirely new system, for the magazine system has been found incompatible with rapid operations such as are now carried out in Europe, and requisitions, contributions, ready-money purchases, etc., will have to be employed in conjunction with it; these latter demand plenty of capable officers, whose time would be fully occupied in attending to purely supply duties. If one department be saddled with too many duties some portion of them run the risk of being neglected; it is to provide against this that in an army special duties are assigned to each branch of the service, with the understanding that these must afford each other mutual support. So it is with the Commissariat Department; the duties of the supply officers are procuring, storing, and distributing supplies, and they should rely on the support of the transport branch in all that relates to their transportation. An interchange of duties *in time of peace alone* would secure to the superior administrative officers that knowledge of both branches so desirable if we wish to obtain the best results from their combination on service.

To raise a large transport corps abroad, which will generally be the case with us on account of our insular position, or even to expand our regular transport into one of sufficient dimensions, is a matter demanding the attention of a large staff of officers. At the outbreak of hostilities the Commissariat is the branch of the service which, above all others, is taxed with heavy duties and severe work. The small contracts and minutiae of routine service are replaced by contracts on a large scale, extensive surveys, issues, shipments, and dispatches of stores of all kinds, preparations of indents, accounts, correspondence, etc. The work at first is immense, and being out of the usual routine, it is embarrassing, and calls for the undivided attention of every officer of the department. This is the very time when a transport on a scale adequate to the requirements of the force placed in the field is to be raised, as a rule, far away from home. At this pressing juncture, the number of regular Commissariat Staff officers being limited, it is not clear how we can dispense with making use of duly qualified Artillery, Cavalry, and Infantry officers for this purpose. With regard to our last European war, General McMurdo has recorded the fact, that military officers sent to effect purchases of horses and mules for the Land Transport Corps during that war proved by far the most efficient. Commissariat officers have also acknowledged the hearty co-operation of military transport officers in various campaigns, and have testified to the cheerful performance of their work under trying circumstances.

In advocating that the transport of an army should form a branch of the Commissariat, we must make an exception with regard to regimental and medical transport.

The carriage of supplies and stores is the principal work the transport has to undertake; indeed, the bulk of the Commissariat work is more in rear than actually with the troops. There is no necessity for embarrassing the transport branch with the charge of the small units of transport affected to regiments which these latter are well able to supervise efficiently. Regimental transport should form a component part of battalions and regiments, with which the transport branch need

have no concern, beyond furnishing from time to time what is needed to meet the wear and tear of continuous heavy work.

Transport is intimately connected with the Medical department of an army, for, the removal of the wounded from the battle-field, the necessary dispersion of the sick, and the provision of medicaments and appliances, on which rest the saving of human lives, depend on transport entirely. It will be urged against a separate transport that the medical pressure for transport is occasional, whereas with supplies it is constant, hence endowing the Medical Department with a special transport must be detrimental to the economical working of the general transport of an army; yet the importance of a separate transport for this department cannot be underrated. The description of transport needed is special, and, as the time for sick convoys to move depends on certain considerations which only medical officers can estimate correctly, it is difficult to foretell when a pressure may arise; who is to guarantee, when the necessity appears, that the Commissariat officers, who are interested parties in the transport, may not consider the needs of their own service far to outweigh those of the Medical Department, thus giving rise to a difficulty which could not occur were a distinct transport affected to this department.

Why should we apprehend a waste of transport from those portions of transport not entirely under the control of the Commissariat? Some Commissariat officers have gone so far as to claim the entire control of every item of transport, arguing that by such an arrangement only the economical working of the transport of an army can be secured. Surely the General commanding, the person most interested and responsible for the success of the operations entrusted to him, will be the first to guard against this waste. Our past wars afford evidence of this care on the part of a General. In Abyssinia, for example, we find Sir Robert Napier reducing the baggage and camp equipage of his officers and men to a minimum to increase his means of transport for supplies. Again, did not Sir Garnet Wolseley, in Ashantee, employ most of the troops he had on the Prah as carriers to supplement his insufficient means of transport?

As the chief responsible agent, a General cannot lay the blame of failure on any department; no fear need therefore be entertained that, in the interests of the army, he will ever refuse the Commissariat all that it can reasonably demand. The completing of the various arms and branches of the service with special means of transport enables each to be ready at any instant it may be called upon to act; a portion of the transport must be permanently, or nearly so, attached to them during a campaign, for a constant changing would cause interminable work, would create disorder and confusion, and would not enlist the attention of the several arms and branches sufficiently in securing the efficiency of the transport means placed temporarily at their disposal.

Commissariat officers do not seem to agree as to the necessity for their department to control absolutely the entire transport of the army. Assistant Commissary General De Fonblanque, for example, in his *Treatise on the Administration and Organization of the British Army*, at page 386, says:—

“There does not appear to be any absolute necessity that the Commissariat should control the entire transport of an army, although such an arrangement would undoubtedly tend to an unity of action and concentration of responsibility, besides furnishing greater security for the exercise of economy in a most important and extensive branch of expenditure; but that portion required for commissariat purposes must, to be effective, be exclusively under its orders.”

Sir John Bisset evidently was of the same opinion, as the following words of his appear to show that he did not contemplate placing the Royal Wagon Train under Commissariat control, but only the carriage required for Commissariat purposes:—

“A most useful description of transport,” he says, “may be formed under the exclusive direction of Commissariat officers; and to facilitate such a direction, the nucleus should exist in this country, which would be very easily accomplished by having on the establishment of the Royal Wagon Train a certain number of corporals and wagoners clothed, drilled, and appointed in the way I have stated, to be on an emergency transferred to the orders of the Commissariat.”

Commissary-General Sir R. Routh, on the other hand, says:—

“Establishments of this kind should not be under officers having military rank, and the same remark applies to all kinds of transport. The machinery of such quasi-military establishments is too cumbrous and the control is not sufficiently direct. The internal arrangements of transport so organized become greater than the business it has to perform. The forms of drilling, the dress, and the military routine, where no military service is required, are so many delays to the real transport service, and the parades are unnecessarily fatiguing to the horses and men; besides which, it involves a great increase of expense.”

In the expedition to Abyssinia, the efficiency of the Lahore Mule Train was a proof of the advantages of this quasi-military organization deprecated by Sir R. Routh. The drivers were not enlisted men but simply hired followers; certain military habits and customs were, however, introduced into the train from its first formation, and these, enforced during a long march from Lahore to Kurrachee, secured the efficiency of the train from first to last and made the Lahore Mule Train contrast very favourably with the confusion and disorder which reigned for a long time in the rest of the transport.

There is no comparison between the small quantity of transport maintained in peace time and the huge proportions this branch of the service rapidly assumes in time of war. To man it efficiently, a call has to be made on already formed officers from the combatant branches, and an element is thus introduced into the Commissariat which is alien to the general constitution of the department. This borrowing of combatant officers is liable to foster friction from two causes; first, owing to the military rank combatant officers possess, in virtue of which they chafe at the very idea of complying with anything like an order from a non-combatant officer; secondly, by the superior ability in administrative matter which many Commissariat officers affect, and which, in their opinion, makes administrative necessities of greater consideration than purely military ones. Caste feeling is difficult to subdue, it is engrafted in the British officer from the very commencement of his military career, and he soon gets to look down on any corps or branch of the service which is not his own. We must study how to overcome this and create an *entente cordiale* between the two branches, so necessary for the good of the service. An appeal must be made to the good sense of the officers themselves to promote a good understanding between the officers of the two branches, and to cast aside anything which may wound the susceptibilities of those of either. The respective heads of the supply and transport branches should be held responsible for the fostering of this amicable understanding, and should repress with a firm hand anything which may be likely to disturb it. To suppress old prejudices is, above all, a matter of tact, which the officers in immediate charge of the two branches should possess in a high degree.

This very necessary amicable understanding is liable to be disturbed by a misinterpretation of the subordination of one branch to the other; thus, if the Transport Service being placed under the control of the Commissariat Staff, is held to mean that a Commissariat Officer, whatever his relative rank may be, has power to command all Transport Officers regardless of their rank, length of service, experience, and ability, the latter will find themselves placed in a very embarrassing position. Whatever amount of forbearance Transport Officers may possess, the false position they thus occupy is not likely to lead to a friendly co-operation. Hence, to avoid friction from this cause, the status and relations of both should be clearly defined, bearing in mind that the Transport Service is not secondary to the supply service, but of equal importance to it.

In war no branch or department of an army can act independently of the General, who is the chief responsible agent: this dependence must be absolute. The control of the transport is delegated to the Commissariat Department as likely to conduce to the best results, but this should not restrict that complete freedom so essential for the leader of an army. A Commissariat Corps, prone to look to the success of its own department as over-riding in importance all other considerations, may indirectly influence the commander's intentions and thus cause a restraint which cannot lead to success in the course of the operations. This was the blot of the magazine system, introduced by Louvois and particularly followed in the eighteenth century, which, by subjecting strategical considerations to those of supply, deprived the commander of all independence.

The Commissariat is an administrative department not fitted by any special training to decide as to the most proper course to be pursued in military operations; its duties are to remove difficulties, to overcome obstacles, to facilitate the intentions and plans of the General, and never by an abuse of power to constitute itself a judge as to the proper course to be pursued.

Commissariat officers, as a rule of general application, attach too much importance to their own branch; to feed and provide for an army in the field is undoubtedly a difficult undertaking, but the main object of military operations is to cripple, overcome, and subjugate the enemy; the supply service is only a means by which to effect this end.

Often military operations have been delayed until the accumulation of an excessive quantity of supplies had been effected, an accumulation which rapid operations might frequently have dispensed with. The Commissariat have an exaggerated idea of the necessity of feeding men in the field with the same precision as when in quarters; is this to form the basis on which to judge of our success in a campaign, and are rapid operations possible with such a system? Brevity is a better test of a successful war, for this a proper training of the soldier to familiarize him with hardships and privations is necessary, his powers of endurance should be cultivated, and he must be got to overcome difficulties with a light heart; our excessive care of him is never likely to secure this most desirable training.

Much of the efficiency of the transport depends on the right selection of its officers; these should not be chosen haphazard on the breaking out of hostilities, but should be really competent ones, cognizant with the details and difficulties of the service. At present the officers are detailed for it without having any special qualification for transport duties, and most of them join the transport as a last resource, rather than not take part in the war.

The secret of guarding against failure and extravagant expenditure lies in proper attention being devoted to all that relates to transport

matters in time of peace. With our varied experience and resources, we should be in a position to put on foot the finest transport of any nation, but we throw away all the experience gained for want of some officer to collect it and frame on it an organization which would stand the test of any war. Transport demands above all experience, and as, owing principally to difficulties of climate, our campaigns are of short duration, the transport (a new one in each case under inexperienced officers) only commences to become really efficient as a campaign comes abruptly to an end. Then the transport is broken up, and with it goes all the useful and valuable experience gained.

To guard against this waste it is indispensable to entrust to a special officer the interests of the transport in peace time. It would take too long here to detail what he should have to do, but we can condense his duties in the following words. To look after all matters connected with army transport at home and abroad, to prepare all that will be needed to secure the raising of an efficient transport on any occasion, or to expand what there is already, and to prepare such a code of regulations as will permit of the past experience being fully utilized from the very commencement of the operations.

Though it appears that the best advantages will be obtained by making the transport a branch of the Commissariat Department, there is no reason why a combatant officer, where he is recognized as the fittest person to undertake the duty, should not be entrusted with its supreme direction. We need the most able officer, whether a regimental or departmental officer is quite immaterial, but he must be relieved of all other duties, and should devote all his attention and energies to the transport only.

The Army Transport Department should supply all branches of the army with drivers, animals, carriages, and equipment; it should likewise provide officers and non-commissioned officers for the auxiliary or general transport, so that one system under one direction may be followed throughout the entire transport of the army.

The Chief Transport Officer on service should have the entire management of everything connected with raising, organizing, and maintaining the corps. He should detail the divisions for duty with the various departments of the army, stations on the lines of communications, base, etc., judging always of the exact requirements of each, and advising the Commissary-General on all transport matters. To him should be entrusted the regular transport train and the auxiliary transport, with all purchasing, hiring, engaging, discharging, etc. In matters affecting this branch he should be supreme, dependent only on the Commissary-General, who is responsible to the General for the proper working of the two branches of his department.

A not unfrequent complaint put forward by Commissariat Officers is that combatant Officers attached to the transport have been always found more ready to comply with demands from Military than Departmental Officers. This cause of complaint will be removed by making the regimental transport as complete as possible. Further, unusual demands for transport means should be addressed to the chief responsible parties only, and the regulations should not be set aside solely to comply with an order because received from a superior officer. It should be clearly defined what military authorities have the power of interfering with the established service, and what circumstances may demand its suspension in favour of a more urgent temporary requirement. It should not be left to individual officers to judge whether to depart from their orders or otherwise, they should have a certain discretion accorded to them, but only in certain defined circumstances, which should be clearly laid down in their instructions.

The Chief Transport Officer and Quartermaster-General should be in very close relation, for the latter is the officer who arranges all the moves of the field army, and all these moves are dependent on transport.

There is no reason why officers should not make themselves acquainted with transport matters, and why there should not be a course of instruction established somewhere, as there is for gymnastics and signalling at Aldershot, and for field-works at Chatham, the qualified officers being noted for transport duties when their services are required.* At present they are taken haphazard, are posted to the transport with little or no experience of any kind in the work they are called upon to undertake, and are generally too few in number for the duties they have to perform. A trained corps of conductors and superintendents also could render valuable assistance in organizing an auxiliary transport. Even working under all disadvantages with an entirely new transport, if the principles which should regulate its economical and efficient working are attended to, the difficulties at first starting will be greatly reduced; but it is unquestionable that officers and non-commissioned officers must become practically acquainted in peace times with these difficulties, and how to obviate them.

Such undeniable military authorities as Napoleon, the Duke of Wellington, Sir Charles Napier, and others, have all been in favour of a disciplined military transport. Speaking of the first, Marshal de St. Arnaud says: "The Emperor made up his mind, and the experience of a long war confirmed this conviction, that it is indispensable that armies should have a train organized on an exclusively military principle."

The Duke of Wellington, writing to General Gordon (Cheltenham, 18th July, 1816) on the subject of the Royal Wagon Train, remarks "It is much more easy, and there are more means and facilities to form cavalry and infantry soldiers in a hurry than to form military drivers. If they are not regularly trained and formed, no reliance can be placed on them, and yet the most important operations of war depend frequently on the due performance of their duty by this description of corps."

Sir Charles Napier writes: "I am convinced . . . that the baggage of an army can never be rendered properly moveable in Europe or America, still less in India, unless it is formed into a corps perfectly organized. It was with great satisfaction, therefore, that I found your Lordship was disposed to such a project. It applies to every country, every army, and every climate." Later on, Lord Strathnairn, in a Report on Transport, uses the following words: "I beg leave to record my convictions, founded on practical experience in India and the Crimea, and a careful study of all the bearings of military transport, that the idea of organizing a "train," of which all the elements would not be under military discipline, is a fatal illusion."

The principal military authorities agree that the transport moving with an army should be a well-disciplined corps. This discipline can only be obtained by giving that part of the transport which accompanies the troops a certain military organization. The regularity of any large body on the march is only obtained by practice, and by complying with certain rules carefully laid down for all ranks. This practice forms an important part of our drill, and to obtain the same regularity in the long transport columns which encumber the rear of a moving army, certain fixed rules must be framed and rigorously observed, and such can only be observed by a body accustomed to discipline and obedience.

* The Depôt Company Commissariat and Transport Corps is now located at Aldershot; every officer and man on admission to the corps joins this company, and is put through a course of riding, driving, packing, etc. The school we need exists, and, with a certain extension of the staff of instructors, classes could be formed there for instruction in transport work.

The expansion of the regular transport must introduce fresh elements into it which must be brought under discipline in the shortest space of time. Military discipline must be introduced because order and regularity, the aim of military discipline, are nowhere more needed than in the close vicinity of an army. The transport of the country only, either by hire, purchase, requisition, or seizure, can complement the small nucleus of trained transport kept up in peace time to satisfy the military requirements to their fullest extent, and this, within certain reasonable limits, also must be brought under military order and discipline. This applies in a special manner in all cases where pack transport is employed.

A civil transport is liable to panics, and requires a large number of troops for escorts. The dread of the drivers to enter the enemy's territory will often add to our other difficulties. In Afghanistan, for example, the camel drivers dreaded at first entering the Bolan Pass; in the Ashantee expedition the Fantee carriers dreaded crossing the Prah. Civil labour is also costly; it is besides a great object to obtain the absolute control discipline holds over the soldier, which is not to be got readily from civilians of the lower classes. A military transport has the further advantage of securing a reserve of trained men in the hour of need (with us a point of considerable importance). Here we have in place of a source of weakness an accession of strength which often we cannot otherwise easily procure. In place of having to guard and protect a host of helpless followers, if we can secure nothing else but their own defence and that of the animals and material under their charge, dispensing with numerous guards which can be more effectively employed elsewhere, and which our small armies can spare with great difficulty, something will be gained. A civil transport can, however, render important services when employed in rear of the combatants, as long as the men run no risk from the enemy and are not removed from the neighbourhood of their homes; the men being in their own district can feed themselves and their animals, thus relieving the Commissariat of much work on their account.

The constitution of part of the transport, that of the first line, being military, and it being necessary that the whole of the army transport should be under the same supreme direction, points in favour of a military direction. Semi-military officers with titular rank will barely suffice; the soldier soon becomes aware of this difference, he is very sensitive on this point, and is more influenced by class than is ever believed. The difference of the status of the several branches of the army have a great influence on him, and he has ever been found more amenable to comply with the orders of a combatant than of a departmental officer. The civil element amongst the drivers and attendants is often not of the best, these men are unruly and troublesome, and require a firm control; a strong military element is needed, with a training to command which a civil department does not sufficiently possess.

The land transport of all armies is generally divided into two distinct parts: the first, or *the first line of transport*, is that portion which moves with the army itself. It is provided for the conveyance of baggage, camp equipage, reserve ammunition, ordnance stores, field hospitals, sick and wounded, and supplies and forage for a limited number of days. For this portion, which is intimately connected with the troops, a military organization is absolutely necessary. The permanent transport being the best trained, equipped, and disciplined, is employed with the advanced portion of the troops.

The other, *the second line of transport*, moves in rear of the active zone of operations, it pushes forward the supplies for the army from

the base as far as the most advanced magazines, and is generally out of reach of attack from the enemy. A strictly military organization for this portion would be superfluous, but properly military constituted cadres of officers and non-commissioned officers to supervise it and work it with regularity and efficiency are necessary. Army transport of the second line is closely connected with the line of communications service. In countries wanting in railways, the numberless requirements of an army and the continual stream of supplies and materials, generally all drawn from the base, necessitate a transport of the second line on a large scale, in these cases it forms by far the largest portion of the transport of an army. This portion moves only up to the most advanced magazine; from this point the first line of transport, divided into departmental and regimental, perform the rest of the work; the first working up to the divisional or army corps dépôts, and the other from these points up to the regiments and corps further in front. In many of our minor wars a military transport does not exist, and there is no difference between the first and second line of transport, the organization of the whole being the same throughout; all alike undisciplined and no sooner gathered together than worked, with little available time to infuse real order or habits of discipline in the large mass of drivers.

The second line of transport, as we have said, will be generally divested of any strictly military character, but strict subordination and regularity must be enforced in these large bodies of drivers. A certain need for drill, or the prompt and simultaneous compliance with certain rules or orders, to impart regularity to the line of march or in the performance of routine duties in the lines, is always sure to make itself felt where large masses are assembled and worked together. It is undesirable that much time or pains should be devoted to this, but any moderate instruction that will impart order and regularity should never be looked upon as useless. Sir John Bisset remarks: "Had I a wagon train to form, I would divest it of all useless military equipment and clothe and drill the men as wagoners, because it is labour and not military parade that is required; though, of course, strict subordination and regularity should be carefully enforced." His making use of the words clothe and drill shows that the idea of a semi-military organization was present in his thoughts when he wrote the above words. The great argument often adduced against a military organization of the transport is that officers and men are distracted from the real object of carrying by having to devote a deal of their time to drill and to the excessive cleaning up of their equipment and kit. On service there is little leisure for this and the transport must be occupied to the fullest extent in transporting, for, as war costs much, the operations demand to be reduced to the least possible period of time. With military officers employed in the transport it will be out of the question to expect from their military education that they will abstain from introducing into it some modified form of military organization. After all any organization must approach the military form, which, above all, aims at obtaining order and regularity in large masses of men, animals, wagons, etc.

In wild and turbulent countries attempts on convoys, the weakest part of the military machinery, will often be made, and in places generally favouring an attack; operating in such countries it will be especially necessary to foster the self-reliance of the drivers, which only a military organization can promote. Trying circumstances will occur in which it will be desirable to secure rapid formations for defence free from confusion, and when the drivers may be required not simply to stand by their animals but also to take part in defending them from the assailants.

CHAPTER II.

TRANSPORT GENERALLY DIVIDED INTO REGIMENTAL, DEPARTMENTAL, AND GENERAL—MODES OF OBTAINING IT, BY PURCHASE, HIRE, AND REQUISITION—THE IMPEDIMENTA DIVIDED INTO LIGHT AND HEAVY—WORKING THE TRANSPORT BY DIRECT CONVOYS, STAGING AND MEETING SYSTEMS—DISPOSITIONS IN VARIOUS EVENTUALITIES LIKELY TO ARISE ON SERVICE.

The Military Land Transport* proper is composed of three distinct parts, regimental, departmental, and general. The first two are those portions of it which are specially allotted to corps or departments in order to render their mobility complete: commanding officers being responsible for the efficiency of the first and heads of departments for that of the second.

A system of regimental transport forms part of our army organization. This is needed to make each fighting unit complete, and for a certain few days able to move in any direction independent of further aid. A certain quantity of transport is therefore now uniformly assigned to each corps, calculated to carry all its equipment, baggage, and necessities, and so constituted as to be divisible amongst the parts of which the unit is formed, such as troops, companies, etc.

Regimental transport relieves the army of a portion of an unwieldy train, the regimental system being called in to reduce to order a portion of an incongruous mass. Each commanding officer can easily supervise the small quantity attached to his corps; the officers and men are all concerned in its efficiency as one of the best means of getting to the front; a good feeling is fostered between the drivers and the men and the confusion in loading is reduced, for the drivers know where to go for their loads and the men what articles are to be loaded on each wagon or pack animal.

Lieutenant-General Sir J. Forbes, in advocating a system of regimental transport, remarks as follows:—

"It is also especially desirable on service that the care of transport animals should be entrusted to those who suffer and benefit from the efficiency of the carriage, and upon whose treatment of the animals in loading, unloading, and on the march, much depends."

It is argued that a system of regimental transport will lead to a quantity of transport remaining inactive for long periods; but it is often impossible when regiments are halted to employ regimental transport for other purposes, part of it must remain inactive, for the very nature of the military service may demand a sudden move, the necessity for which on service may arise at any moment, particularly when within striking distance of the enemy. Economy demands that a waste of transport should always be guarded against, but this should not be secured at the risk of making corps immovable, which is a greater evil. Regimental transport should be reduced to what is strictly essential, afterwards the corps should not be unmobilized by having their special carriage taken away from them. The employment of regimental transport for general army purposes when reduced to a system is an erroneous plan of action; it has crept into our service as we have generally worked with insufficient means and have had to collect together all we could lay our hands on and work it incessantly. It may not have proved

* Railways are undoubtedly land transport, but by the term *Land Transport* we mean to specify that large portion of the transport of an army in which the conveying is done by carriages, pack animals, or carriers.

inconvenient in our small wars, because long halts were necessary from time to time to enable supplies from the base to accumulate; because we could remain inactive in the presence of an unenterprising foe, and the choice of time in delivering a blow rested with us, as we were generally the assailants; but one might as well take the draught horses from the artillery when halted to use for transport purposes on the plea of waste of means as to deprive corps of that part especially affected to secure their mobility. Transport, if worked incessantly, will soon wear itself out, particularly where forage is scarce or bad, so periodical rests have their advantages and are necessary. Besides what may be looked upon as a waste of means by an interested department may be considered by a sagacious and far-seeing commander as a necessary sacrifice.

Whilst on the subject of regimental transport, let us remark that an arrangement which aims at removing one officer and twenty-three trained non-commissioned officers and soldiers from the ranks of each infantry regiment for other purposes but fighting, at the very outbreak of a war, cannot but be extremely inconvenient. We are not so well provided with trained men to neglect this point, and, when we have plenty of other sources from which to draw expert drivers from, it appears undesirable to reduce the number of our fighting men for this purpose. Transport men should be obtained from other sources, and if the element of discipline is absolutely necessary from the very beginning, let men from the reserve or militia be drafted into regiments in preference to turning into drivers the men latest under instruction. The numbers also detailed for each regiment seem not to be sufficiently large to demand the services of an officer, and it is recommended as a more economical arrangement, the employment of an officer per brigade to whom could be attached a staff-sergeant and such artificers as are necessary to undertake the shoeing and carrying out of all repairs both of carriages and harness.

With regard to regimental transport, as it is admitted that troops when concentrating by rail should entrain complete with transport and everything that may make them capable of acting at once on detraining, it appears at first sight that the same system should apply to troops embarking for service. It is a question, however, demanding serious consideration whether the best results would be attained by conveying the regimental transport with each regimental unit. Special ships with special fittings are necessary for the conveyance of horses and other animals by sea, and it might be found preferable to convey a large number of these together than to have to sacrifice accommodation on board every infantry transport for forty-eight horses, besides what is required for the officers' chargers. It should be borne in mind that in a debarkation the land transport cannot be landed until a secure footing has been obtained by the infantry. All mounted portions of the army and heavy *matériel* taking longer time to re-embark than the infantry, would be compromised if landed before this arm has firmly established itself. Horses and other animals require rest after a long passage by sea and cannot be worked at once; and as the organization of a force which has been divided and sub-divided for the purpose of facilitating its transport by sea can only be completed after debarkation, the few days necessary to carry it out will afford the rest the animals require; this rest being necessary before the animals are worked it will be immaterial whether they proceed to the port of debarkation in the same ship with the corps they have been detailed to serve with or not, for they can rejoin it at leisure. Only where a large number of animals are shipped together the proper veterinary superintendence can be obtained, which is impossible to afford where animals are

divided amongst a large number of ships. The superintendence of an experienced Veterinary Surgeon is very essential to guard against losses of animals during the passage, and to ensure their being landed in a proper condition, so little debilitated as to be able to resume work after a few days' rest.

The regimental transport should form part of the establishment of all corps in the field, as the advantages of such an arrangement are now fully recognized. If this is judiciously organized, each corps will be more complete, and the duties the transport corps will have to attend to will be to a certain extent reduced, for the continual detailing of small fractions of transport to corps, on every occasion where a move is intended, cannot but prove a source of confusion and of additional trouble for the transport officers.

Lieutenant-Colonel R. C. Low, in his report of the march from Kabul to Kandahar, says:—"The Regimental Transport Officers and their soldier assistants ought not also to be forgotten in reporting on the march of the force; the latter had often really desperate work, owing to desertions of Kabul drivers. Some regiments were so reduced in this respect that the soldiers had to load, lead, and attend to the transport animals, and from watching the march of the transport on this trying occasion I am bound to say that I consider it doubtful if the march could have been done in the time had not the Lieutenant-General for months previous insisted on regiments as a body, and soldiers individually, learning something of transport work, and that all ranks should take a share in the working of this important branch of the military work of an army in the field."

The loading is such a very important point to attend to, that, in camps and stations where permanent transport is maintained, some arrangement might be made to give the rank and file very useful instruction in loading both wagons and pack-animals.* It might be found possible to tell off for this purpose, on certain days, a few transport wagons and pack mules, and instruct companies of regiments in loading by rotation. See extract from "Report of Kabul Committee on Equipment," in page 255.

That portion of the transport of the first line which is especially assigned to the various departments on service constitutes the departmental transport. It has to convey the baggage, equipment and necessities of the staff, the reserve ammunition, hospital equipment, all the primary necessary medical and veterinary articles and appliances, Commissariat supplies, and ordnance stores; in short, all that is needed to make the field army quite complete for a certain period of days. In the organization of the army the needs of each department in transport are calculated with reference to the number of days the army can move without assistance from the rear. When this assistance is needed we have to fall back on the foremost magazines, then the departmental transport becomes a link between the field army and the magazines, and a large portion of it is employed in moving supplies and stores from the latter to replenish what is gradually consumed by the first.

The regular transport must be assisted as much as possible by the general transport to be able to retain its proper place with the army in front. Under the appellation of general transport are included all transport services called in aid of the regular or permanent train, which never possesses all the resources necessary to perform the entire con-

* If no other means can be procured, the instruction in loading pack animals might be carried out in gymnasia by using the vaulting horse. A few stalls might be fitted in cavalry and artillery barracks to teach the soldiers their use on board ship, and a few disused wagons and trucks might be kept at our standing camps for instruction in entraining and detraining.

voying service of an army. The general transport is not detailed for service with any special corps or department, and is employed mainly on the line of communications according to circumstances. The continual stream of reinforcements, supplies and stores moving up to the army, and the return to the base of sick and wounded and other embarrassing *impedimenta*, demand a transport on a large scale; the general transport therefore requires to be formed on a large scale, and constitutes by far the largest portion of the whole transport of an army. It is generally formed of the transport of the country obtained by hire, purchase, or requisition. It should be divided into manageable fractions, to each of which a certain number of officers and non-commissioned officers should be assigned, to secure that ample superintendence so very necessary for the economical, efficient, and regular working of the same.

The general transport is employed chiefly on the line of communications and has to be largely used, for an army requires large quantities for pushing up reinforcements, conveying supplies, forwarding warlike stores, or removing the sick. All countries have not progressed alike in laying down railways, troops will have therefore often to operate in many where these artificial roads are scarce or wanting, and this, as we have already observed, applies in a special way to us who have generally to make war in wild countries in which we can only make use of the old slow methods of carriage. In well populated, industrious countries, where the soil is regularly tilled, and good roads are plentiful, there will be no serious difficulty in requisitioning means of transport. In others, however, neglected, barren, and deserted, nothing worthy of the name of transport will be found, as it will always be useless to look for animals in countries where no fodder is obtainable: an army will therefore have to purchase or hire largely to provide for all it requires on this head during a campaign. Money and transport are two great requisites in war, particularly the last in those cases where all the supplies are to be forwarded from the base of operations.

The amount of transport required in each case depends on the quantity of provisions and *matériel* to be carried, which must be in keeping with the number of troops and followers employed, and the length of time calculated necessary for them to attain the object of the expedition and to return to the base. We must remember that in most cases we have generally to carry everything and cannot rely on obtaining anything in the country itself.

In some cases, where means of transport are not wanting, all the available carriage may be withdrawn from the neighbourhood of the army by the enemy, or by the owners themselves either to escape rendering assistance to the invader, or through fear of ill-treatment or of losing their property for a time or altogether.

Where the line of communications is a railway line the principal portion of the supplies for the use of the army will naturally be conveyed by rail; but, as transport by rail is always liable to be suddenly interrupted by the destruction of any portion of the line, caused either by the enemy, by negligence or accident, means must be at hand to provide against this interruption by returning here also for a short time to the old system of transport by convoys of carriages or pack animals.

As it will be impossible in this case to foretell where and when the obstruction may take place, arrangements must be prepared beforehand to call the old system of transport in aid of the army at a very short notice. The preparation of these means should be the care of the transport officer on the staff of the Inspector-General of the line of communications. This officer must therefore ascertain what are the best means for replacing the transport by rail on the various parts

of the line, and should know exactly where these are to be obtained and also what they amount to. The only way of procuring a large quantity of transport at a short notice is by requisitioning for what is required; but, to do so with effect, a precise knowledge of the amount of transport any place can supply should be obtained beforehand, hence the transport officer, with the assistance of the civil commissioner, must ascertain from the local authorities the description of carriage used in the country for general purposes, the average weight of load carts and pack animals can carry, and the quantity of each description available in the various places. The representations as to the transport animals likely to be obtained in certain districts are often not realized, because these are based on suppositions rather than on facts, or because, though the animals abound in the country, still the inhabitants cannot dispense with them, and are not to be tempted to part with them even by the offer of a high price. The collection of a large number of pack animals and country carts demands a certain time, as these are spread over a large area of country; the larger the number required the longer it will take to gather them together. In a country intersected by railways no great difficulty need be apprehended in the way of collecting a sufficient number of country carts.

On entering an enemy's country it would be desirable to institute a census of all the means of transport available, in other words, a reconnaissance of these means should be made, visiting all towns, villages, farms, etc., to a certain distance on each side of the line of communications. The civil authorities should assist, giving information and making out lists of owners, etc. An order might be given for registering and numbering each cart, horse, mule, bullock, etc., or a small tax imposed by means of which the owners, in taking out a license, would, without suspicion, register the number of their vehicles and animals. All unregistered animals and carriages being confiscated.

On any obstruction on the railway line being communicated to the transport officer, he will have at once to set to work on the data he has obtained in establishing a temporary transport to provide for a continuous flow of supplies, etc. If the transport is required for a long distance, he will have to establish relays of animals at various stations, in fact, to organize a regular staging system, a system which will always be found to be the most expeditious and economical. It is mainly on account of their liability to be easily destroyed that railways should be used as lines of communications always in conjunction with the ordinary roads of a country.

In examining the employment of railways in war, it will be seen that, generally speaking, there is a break in the line between the front of an advancing army and the serviceable end of a railway in its rear, for, however good the railway corps may be, the repairs of the line can never keep pace with the marching of the troops, and it will be by good management and the greatest exertion only that it will be put in working order one or two marches in rear of the field army. The length of this break depends upon circumstances, but over this length an efficient transport service by means of carts or pack animals must be provided, for in the vicinity of the enemy wheel or pack transport are the only kinds that can be used.

The importance of military transport (wheel and pack) therefore increases in proportion as the enemy is neared, until at last it becomes the only means that can be made use of. The supplies sent by rail can only be pushed forward by special convoys of carriages collected in the neighbourhood of the furthestmost point up to which the line is available for traffic. These convoys are needed to reduce the distance the regular transport would have to go to the rear to replenish. If this

distance is great, the supplies would inevitably fall into arrears unless they are pushed up by convoys to within easy reach of the regular transport. Railways do not lend themselves to distribute what they convey in bulk, and to effect this, a description of carriage is needed which can move in any desired direction and change it suddenly to meet altered circumstances. The Germans, for example, have for this purpose with each army corps five Fuhren Park columns of 80 country carts each, carrying six days' supply of rations and corn, in other words, a park of 400 carriages for each army corps.

The military division of the army transport will be with the troops in front, it is the civil or auxiliary (what is usually called "general transport" to distinguish it from the regimental and departmental) that principally occupies now our attention, or that branch which keeping up the communication between the departmental transport in front and the magazines in rear, comes under the orders of the Inspector General of the line of communications, whose transport officer must arrange the details for this service. The formation of an auxiliary transport for employment on the line of communications becomes imperative and has generally to be found on a large scale, for to enable an army to live in the field a large quantity of transport is absolutely necessary. Its dimensions depend on circumstances, and it appears impossible to determine its strength with any approach to accuracy. The resources of the country in transport should be fully developed for they are indispensable to complement the small nucleus kept up in peace time, which nucleus is needed to impart to it discipline and cohesion. It must be left to the transport officer to utilize every available means of transport, to ascertain the carrying capacity of the various vehicles to be obtained in the country, and to organize the auxiliary parks accordingly. The capacity of the vehicles, the carrying power of the animals (both draught and pack), the state of the roads, and the amount of goods to be carried, can alone determine the amount of auxiliary transport needed.

Economy in transport demands that all surplus animals and carriages whether of regimental or departmental transport, be returned to the transport officers the moment they are no longer needed for the service for which they were originally provided.

The transport officer may on occasions have to provide transport, not only for the *matériel* but for the conveyance of soldiers, for example, to occupy suddenly an important post, to move rapidly forward much needed reinforcements, etc. Marlborough and Napoleon both moved troops by these means, and we have many examples of it in the narratives of the Indian Mutiny. Mobility, with us especially, has often to make up for want of numbers. At times circumstances will demand that the troops should march as lightly equipped as possible and, with little notice, carts will be required to carry the men's packs.

A transport train may be either a permanent one kept up in peace time of modest dimensions, to be expanded when needed to meet the requirements of an army placed on a war footing, or it may be a train raised purposely for the occasion, to be disbanded and broken up when the operations having come to an end there will be no further need for it. The peace establishment of a transport train must, for just reasons of economy, be kept within very narrow limits; from this two serious drawbacks will arise, first that it will be hopeless to expect to obtain the best animals and equipment when the train has suddenly to be largely augmented, inferior animals and articles will have to be purchased, and at enhanced prices; secondly, there will be a demand for expert drivers far in excess of the supply, a lot of worthless men will offer themselves for service who will have to be taken on, and

with them will be admitted an element of inefficiency in the train.

The small transport corps kept up in peace time can only be looked upon in the light of a training establishment; in war it must assume a sufficient magnitude with the least possible delay, and the greatest economy. The expansion needed is generally effected in most regular armies by demands on the ordinary transport of the country, the resources in horses, mules, and carriages having been fully ascertained by means of a census: this system is considered to secure promptitude and economy. To obtain in every case the best results, a most thorough organization is necessary, and this can only be prepared in peace time. The British Army, as a rule, cannot count either on the employment of railways, or on the ordinary transport of a country to the same extent as other armies, for the wars it engages in are of a very exceptional nature; it has often, therefore, to raise a special transport for the occasion.

The raising of a sufficient transport is a question of time; our transition from peace to war is generally very sudden, and insufficient time for preparations is one of the causes of our transport difficulties. We dread incurring unnecessary expenditure in making preparations whilst negotiations, by which it is hoped to stave off a war, are progressing; these negotiations carried on with people who construe the desire for an amicable settlement as a sign of weakness prove generally abortive and valuable time is thus lost. If peace is ultimately maintained we should not grudge the small expenditure incurred, for, besides being saved the heavy burden of a long and protracted war, we have been prudent in providing against the risk of finding ourselves unprepared on a failure of the negotiations. In the countries we operate in we often find the supply unequal to the demand, or highly unsuited for military operations, so that far off sources of supply have to be brought into requisition. We certainly can, with our money and our ships, purchase pretty well in every part of the world what we need and have no difficulty in conveying it to the seat of war, still time is needed to effect these large purchases first, and again time to convey what has been purchased from one distant country to another.*

The difference between parsimony and economy in the matter of transport does not seem to be thoroughly understood; very considerable sums are expended continually in raising transport for our frequently recurring wars which would have paid over and over again for a moderate well organized transport corps, which, with a certain expansion, would have been sufficient to meet our requirements on service. The mobilization of our Indian Army, for example, is proverbially slow and the want of transport must be accounted as one of the main reasons for this. How is it possible with the Commissariat and Transport department so thoroughly reduced in time of peace to expect it to be ready at a few days' notice when a war suddenly breaks out? The readiness to commence a campaign and the success of the first operations will always bear a great effect on the whole of the war. To be ready we need transport, and not to keep a sufficient nucleus in peace time, backed by a well prepared organization for its expansion in war, is not real economy.

Army transport can be composed either—

- (a.) Of a properly organized body of drivers with carts and animals the property of the State, the whole being under proper military supervision with a special organization.

* The mules purchased in New York for the Zulu War were only landed at Durban on the 21st of May, 1879, though most of the reinforcements had reached Natal by the end of March.

- (b.) Of carts and animals furnished by contract on hire.
- (c.) Of carts and animals requisitioned in the country in which the operations take place.

A transport train the property of Government, raised for a special occasion, entails a very large expenditure of money in the purchase of animals, carriages, harness, saddlery and equipment, and often for the conveyance of all these by sea to a distant shore; transport of this kind will, as a rule, be more expensive than any other, but at the same time it is the most efficient and reliable, for the choice of animals rests more with us than would ever be the case with hired and requisitioned transport; we have a greater interest in looking after the animals and *matériel*, and at the conclusion of the war the Government will have a valuable property to dispose of.* There is no other way but this for raising a transport train for expeditions carried out in countries where the general means of transport are either entirely wanting or insufficient. Here the transport becomes one of the main items of expenditure, a very considerable number of animals and a quantity of *matériel* having to be purchased at very high prices, part of which at the end of the campaign, when the transport is broken up, will have to be sold at a loss, simply because there is no demand for them. As we often purchase in foreign markets we should ascertain beforehand which out of all these are the best for each description of animal, purchasing when the necessity arises in such as are most suited by their position with regard to the theatre of war. A large demand will naturally raise the prices, and particularly with us, there being a notion abroad that England can and will pay.

Hired transport can only be obtained in exceptional cases, and then, as a rule, it has been found to be far from satisfactory. In India, for example, a large quantity of transport animals can be obtained from contractors on hire; this would apply likewise to friendly or allied countries where it is politic to abstain from enforcing requisitions on the inhabitants. The Indian transport system is principally a contract system where owners supply a number of animals at a stated monthly rate of payment for the use of an army in the field. Where transport is furnished on hire owing to a certain amount of coercion being exercised by the civil authorities on individuals, it approaches very closely to impressed transport. The supply in India seldom fails, though it has often had to be largely supplemented by purchases; however, it is inapplicable to many of our cases, and in India it only answers well on account of the unbounded confidence the contractors have in our power, and, above all owing to their experience of our habits of punctuality in discharging our obligations; if employed for service out of India it would certainly break down.

Oftentimes people will object to letting out transport to accompany troops, as their habits, and those of their animals, are seriously interfered with, whilst experience is totally set aside. When troops and transport are moving together the military officer may either endeavour to complete his march as soon as possible, to obtain for his men the rest they need, or may only desire to make a long halt after a certain regular lapse of time, independent of the hours and locality an experienced man would choose as being most advantageous with due regard to the endurance of his animals or the facilities for grazing. The officer looks to his men, the other to his animals; both may be right, but, as the efficiency of the marching man depends on the aid he obtains from the transport, it

* In the Zulu War it was calculated that eight months hiring would have been less economical by over 3,440*l.* than purchasing the whole stock of transport required, and paying wages for the same period.

seems that of the two his requirements should be considered as secondary to those of the transport. This demands the serious attention of superior officers, and the officer in command should be frequently reminded that the experience of the transport conductor in the management of his animals, in the amount of labour he considers them able to perform, and the hours of rest and feeding they require, deserves consideration.

No great reliance can be placed on transport supplied by contract, and the security which can be obtained from contractors in war time must necessarily be very small; should a contract suddenly fail the consequences may be serious. In a transport the property of Government, a commander is well acquainted with the state of the same and can guard against a break-down, but a contractor relieves him of all trouble, and when his contracts fails a commander is left in a bad plight, for up to the last moment the contractor will withhold from him any information which might have enabled him to take steps in time to provide against the collapse of the contractor's engagements. The contractors, though well and regularly paid, may neglect looking after the cattle and having that care taken which animals doing continuous work are so much in need of. No particular selection can be made, and compensation, which often leads to neglect and dishonesty, and always to complication in the accounts, must be given for animals that die, are lost, or get hurt.

Where transport is obtained by contract all the obligations of the Government and contractor are entered in the agreement. The contractor furnishes the animals, carriages, harness, drivers, superintendents, etc.; as a rule, he attends to the feeding and foraging, to the payment of the drivers, to the shoeing of the animals, repairs of all kinds and replacements that become necessary from time to time during the duration of the contract. The terms of the contract must be *very carefully* drawn up to leave no doubt in settling claims. These demands should be settled quickly, which is impossible, unless the terms of the contract are very clear and definite. In using contract transport, the officers supplied with it should be furnished with a copy of the contract, so that they may become acquainted with those portions of the agreement a breach of which may give the contractor a claim for compensation.

Hiring and purchasing to a large extent must have a great effect in raising the prices of transport means, for owners will not scruple to avail themselves to the fullest of their advantage when they become aware that Government must inevitably purchase or hire largely. It cannot be otherwise when of a sudden a very extensive demand is made for anything that is pressingly required. In the Zulu war, at one time, many owners were holding back waggons and oxen with the view of forcing the Government to give them higher prices, though from 2*l.* to 3*l.* a day was being given for the hire of a waggon and a span of oxen. It was recommended to solve the difficulty by placing the colony of Natal, as far as the pressing of carriage only was concerned, under martial law, what was required being pressed and paid for at a fair rate; but the Colonial Government were not in favour of such a measure. In the absence of competition, or where there is a combination amongst the owners, very high prices will be naturally demanded, in such cases it will be necessary to make a firm stand against exorbitant rates from the very commencement. We should guard against spoiling the market at first, which would have the effect of making it more difficult to obtain further supplies later on: if there is plenty of transport in the country it will be forthcoming at a reasonable rate. In using carriage by hire the owners should receive, over and above the

fair market rates of hire, an additional sum to compensate them for the disadvantages and discomforts connected with the military service.

In countries where the feelings of the inhabitants do not deserve any special consideration paid or unpaid requisitions for the general transport should be resorted to. Every effort should first be made to obtain transport in the open markets, and only when it is found impossible to get it by these means it should be pressed. Requisitions for either transport or supplies have hitherto scarcely been recognized as part of our administrative system, and our legislation has not fully provided for them even in our own possessions. Should we have occasion for placing a numerous army in the field in Europe we would undoubtedly have to follow the custom of other armies on this point.

Requisitioned transport has been found generally to work well when the owners and drivers have been employed in the neighbourhood of their homes, and when they have had no risk to apprehend from the enemy. It will have to be largely used in war, and if properly organized and supervised, will be found to answer well as a second line of transport for use on the line of communications.

Transport procured by the aid of requisitions cannot be obtained in all countries alike; in the poor and wild countries where our troops often operate there will be seldom any transport to requisition, but in all cases where it can be obtained certain rules should be observed to secure the best advantages from its employment. The principal drawbacks to this description of transport are that the owners part with it reluctantly, and the drivers serve unwillingly, to which should be added that, out of a large number requisitioned, there will be many carts and animals unfitted for the work, sure to break down in transit. What we have to look to here is how best to reconcile the owners, how to check the desertion of the drivers and consequent loss of transport, and how to secure serviceable animals and carriages. To obtain the goodwill of the owners the requisitioned transport working, either from place to place, from day to day, or for a limited number of days, should work if possible in the close neighbourhood of the owners' homes where they can keep an eye on their property. From this arrangement a double advantage will be secured, namely, that the drivers will be saved from enduring excessive discomfort from a prolonged absence from their homes, and the commissariat will often be relieved from the trouble of providing food for the men and forage for the cattle. It will be found a good plan to pay the drivers, and to pay them fairly, and, when circumstances permit, to fulfil strictly all promises and obligations with regard to pay and duration of service. The owners and drivers of requisitioned transport should receive their rations and forage in kind or in money where these can be purchased; it is not advisable to pay them in bonds, as a loss may be incurred in cashing them or some delay experienced in getting the money which they need to provide for their immediate wants. In some cases, to secure the efficiency of the transport animals, their feeding must be taken out of the owners' hands; on the line of communications from Sukkur to Dadur, in 1878-79, for example, it was found that the owners, though well paid, had neglected the bullocks; the camel drivers likewise, though well and regularly paid, could not be trusted with the proper feeding of their animals. At the completion of a service the carts and animals should be discharged, a certificate being given to the owners to show the work they have been employed on, which will save them (except in urgent cases) from being pressed again whilst on their way back to their homes. Where desertions have been frequent amongst requisitioned transport, guards should be posted at bridges, fords, and ferries to stop

all carriage coming from the army whose drivers cannot produce a discharge certificate. To secure good animals and carriages a larger number than are actually needed should be demanded in the first instance, discarding, after a careful inspection, all those that appear unfit for the work.

Requisitioned transport must be obtained through the agency of the Civil Commissioner of the line of communications, who should issue his orders to the local authorities to have a certain amount and description of carriage forthcoming at a determined place by a certain time. There will occur cases where either the people will be unwilling to comply with the requisition, or the local authorities will pretend inability or want of power to enforce it, in all such cases the presence of a detachment of communication troops will be needed.

A requisition for transport presses more on the inhabitants of a country than any other, for in a requisition for supplies the inhabitants are called to surrender what is not actually necessary to them for the moment, namely, part of what they have stored up until the next harvest; but with carriage they give up what they actually require for carrying out their agricultural labours, or it may be, in some cases, that the owner depends entirely on the hire of his wagons and animals for his livelihood.

Requisitioned transport must be placed under military supervision, and this should be on a sufficiently large scale to provide against the desertion of the drivers and the loss of carriage. The same individuals should not be retained too long for the men will then remain more willingly, whilst a further advantage will be obtained in frequently renewing the animals and carriages, that these will be in a better condition for the work required; the owners also will be less inconvenienced in sacrificing for a long period carriage they very much need for their own work. Requisitioned carriages can only be of the model in general usage in the country. Labels should be affixed to each to show to what service it is assigned, likewise the superintendents and drivers should be furnished with a badge bearing the number of the carriage and the division of the transport they temporarily belong to. From the day they are engaged the drivers will be entitled to rations and forage, or a money allowance in lieu thereof where supplies are procurable: payments made day by day will tend to check desertions. One of the advantages of requisitioned transport is that, being the transport of the country, it will be well suited to its nature, to the breadth of the roads, the steepness of the inclines, etc.; on the other hand, it will be a disadvantage that the officers and others placed in charge of it will seldom be acquainted with the language of the drivers and will have to communicate their orders and instructions through interpreters. A loss of power must inevitably be the result on all occasions when a chief and all his subordinates can only communicate together through a third party.

Our allies in the Crimea declared that they found by experience that all auxiliary transport, formed either of civil elements entirely or of animals and *matériel* the property of the State driven by civilian conductors, was not to be depended on and was a waste of public money. The only system which stood a severe test with them was the formation of well organized provisional companies, the animals and *matériel* being the property of the State and the *personnel* exclusively drawn from the army. This has not, however, been found the case in our army, where the undisciplined transport has had generally hard work to perform and has done it well. Civilian drivers are no doubt more expensive than military ones; they are more liable to panics, and there is a certain absence of absolute control over them which is not

apparent when the drivers are subject to military discipline. To bring them in the first line of transport in a European war, where strict discipline and military order are rigorously maintained, would be unadvisable; but in our small wars little inconvenience has hitherto been found in doing so, this is probably owing to their unbounded confidence in the white man, and to their belief of being guarded from personal danger whilst under his protection.

The recent improvements in the arming of the troops, and the increased care bestowed on the soldier have considerably augmented the transport requirements of armies. The use of breech-loaders has augmented the amount of ammunition to be carried for the infantry; with the new arms arose the need for shelter trenches which in their turn demand a supply of tools being always kept with each battalion on service. The number of guns employed in war and the facility for loading them have also increased, while the number and size of the ammunition reserves are more considerable than they were. In place of collecting boats and *matériel* locally for the passage of rivers, as heretofore, a pontoon train is provided. A field telegraph equipment is deemed indispensable. The operations being more rapid than they were formerly the greater the reason for not overweighting the soldier, and in some cases his kit has to be carried for him. The relief and care taken of the sick and wounded has likewise received, as it justly deserved, a great impulse; but with this the number of ambulances, carriages, and other means of conveyance for medicines, hospital comforts, appliances and equipment have also augmented. Notwithstanding all these additional wants, the importance of continually studying how to diminish the transport train to render an army more moveable has not decreased. It is an incontestable fact that the greater the wants of an army the less moveable it becomes; to bring a war to a speedy and successful termination an army must obtain as much mobility as possible, and this can only be obtained, first, by reducing the transport train within such limits as will not interfere with the efficiency of the army; second, by endowing it with a methodical organization and such a system of echelon as will permit of the train being within reach of the army without hampering it at all times by its presence.

Every corps should have with it its light baggage containing all that is required for the daily wants, the heavy baggage and other *impedimenta* being kept in rear under a sufficient escort in some place which is at the same time easy to defend and easy of egress. Even the light baggage should be reduced to a minimum in all cases in which an engagement is deemed imminent.

With regard to the *impedimenta* in a general way, though modern armies cannot dispense with a large quantity of means of all sorts, for the application of science to military purposes and the increased care taken of the soldier has made the wants of an army more complicated, and the transport more cumbersome, still the columns in movement demand being kept unhampered by the larger portion of these. The length occupied by the troops in column of route is very great, and we should guard against adding to it by allowing an extensive transport train to accompany them in their movements. To encamp also this train amongst the troops at the end of every day's march will be found to be conducive to an embarrassing encumbrance without any corresponding advantage being obtained thereby. The transport train contains an accumulation of resources and many things very useful after a fight but of no avail in camp or bivouac before it; these will only introduce elements of danger and anxiety if retained constantly under one's sight. On examining the composition of all that constitutes the *impedimenta* of an army it will be found that there are,

amongst others, a quantity of things which are not essential for every day's work but which are only accessories; these, being needed mainly from time to time, or on special occasions, should be kept close at hand but never in the midst of the troops. What moves with the troops should be enough to satisfy their immediate wants, permitting them to dispense for several days with the rest of the *impedimenta*. The field army should always be kept ready for action, and no army can be said to be in that state when embarrassed by the presence of a cumbersome transport train. From retaining with the army both the articles which are immediately necessary and those that are only accidentally so, no other result can accrue but an embarrassing accumulation of *impedimenta*, exposed to the risk of being lost in case of defeat for want of time to move them to the rear: the anxiety for securing their safety also cannot but seriously affect the freedom of movement so necessary to an army. Hence it should be a rule to avoid the encumbering presence of a numerous wheel or pack transport, which should follow in rear in a line parallel to the front of the army at a convenient distance.

Just as the aim of a proper established communication service is to improve by a division of labour the mobility and freedom of the field army, so should a judicious division of the *impedimenta* into two classes *absolutely indispensable* and *occasionally required* assist in carrying out this object. A line should be drawn between the two classes of *impedimenta*, the first restricted within judicious bounds should move and encamp with the field army, the other should follow its movements, but with an interval of a short day's march. The reserve transport does not march at the same rate as the troops, neither need it follow all kinds of roads; being indifferently horsed and drawing heavy loads, on the contrary, the best roads should be assigned to it.

The huge trains that follow an army will be found to consist mainly of baggage, hospital establishments, reserve ammunition, supplies, engineer park, pontoon and siege train; to these should be added the auxiliary charitable ambulances, treasury chests, postal and telegraphic vans and *matériel*. In all these, it is obvious that there are resources collected to last for many days, and to meet losses caused by serious engagements, consequently they cannot all be constantly required, whilst their presence in camp and on the line of march cannot but cause serious inconvenience and anxiety. If the result of a battle has been favourable, the train can follow the army, or even rejoin it, if necessary; if the contrary, it will be directed to retire in plenty of time, obtaining such a start that it will be of no inconvenience to the troops.

Taking the baggage as an example, it can be divided into indispensable or light, viz., that which is absolutely required for the daily wants of the troops; and accessory or heavy, only required in cases of halt. This division was fully accepted by the Germans in their late war in France; their regulations lay down that "as a rule, the infantry pack horses or the company carts of fusilier or rifles, as also the regimental staff wagon, follow immediately in rear of the infantry, and forms what is called the small train, the other carriages, officers' baggage, equipment, ammunition, medicine, are collected divisionally, and march in rear not able to rejoin the troops in camp every day." Both in the campaign of 1866 and of 1870-71, we see this principle carried out, the ammunition columns, the provision columns, the ambulances and heavy baggage of the Prussian and German armies followed their respective divisions a day's march in rear, moving by the same roads these had advanced by.

The division just indicated for the baggage can be applied to

every other part of the *impedimenta*, for the Senior Commissariat Officer will not need at all times the presence of all his supply columns, which contain provisions for several days and are intended to complete what the resources of the country cannot yield. With a proper system of requisitions, in productive districts, having to fall back on the reserve provisions being the exception and not the rule, it will be sufficient to have the convoy within an easy march in rear. The Principal Medical Officer will require the greater part of the hospital establishments only where a severe engagement has been fought. The reserve ammunition will likewise be required only after an engagement to replenish what has been expended in the combat. The probable employment of the pontoon train can be ascertained beforehand from the topographical maps and information. The Engineer park is called to render due assistance by special works undertaken principally during the periods of halt. From all this it will be gathered that the recommended division of the *impedimenta* into two distinct portions will not present any material difficulty, the heavy portion of it marching independently of the army will move with greater ease, ceasing to hamper in the slightest way the freedom so much needed by the troops, and always being within close reach in case circumstances should demand the assistance of any of the means it contains.

We have quite recently seen the serious results arising from a large cumbersome convoy being kept with the troops in the immediate proximity of the enemy. The loss on the fatal field of Isandhlwana of 132 waggons, 1,400 oxen, 400 shot and shell, 1,200 rifles. 250,000 rounds of small arm ammunition, some 60,000*l.* worth of commissariat stores, and over 2,500*l.* in gold would never have occurred had the principle been observed of keeping few things with the troops and powerful means echeloned some convenient distance in rear.*

At the battle of Maiwand our troops were likewise encumbered by a large amount of stores and baggage, the escort for which reduced the small force at the General's command by 300 foot and 140 sabres. The Brigade consisted of 2,599 combatants and was accompanied by about 3,000 animals. The transport animals lost amounted to 1,676 camels, 355 ponies, 24 mules, 79 bullocks, and 291 donkeys.

The Red River Expedition, under General Banks in 1864, is, among others, another example of the danger incurred by moving within striking distance of the enemy encumbered by a heavy convoy. (*See "Les méthodes de guerre actuelles et vers la fin du XIX^e siècle," par le Lieutenant-Colonel Pierron, p. 1083.*)

An army must preserve its line of communications, and prevent the enemy interposing between itself and the base; the measures taken with this object should afford sufficient security for the safety of the convoys in the immediate rear. A small body only can substract itself from observation, and an unexpected attack of a few raiders on convoys which follow the troops need only be apprehended; the cavalry should prevent the possibility of this, but should it be unable to do so, the usual escort should be sufficient to deal with them and defend the convoy.

A commander must not only carefully organize the march of his *impedimenta*, but he must also take all those precautions which will free his troops of all embarrassing encumbrances in the hour of combat;

* Captain H. H. Parr, in "A Sketch of the Kafir and Zulu Wars," describes the difficulty of taking the large number of wagons of No. 3 Column across the Buffalo River into Zululand, but of the return after Isandhlwana, says: "Harness, four guns and wagons, and one mule wagon which had carried the biscuit, comprised our wheeled vehicles."

these must be either left behind in advancing, or sent timely to the rear to clear all the roads leading to the battle-field.

The transport of the first line moves with the troops, and must either accompany them or conform closely to all their movements; that of the second line, which is employed on the line or communications from the base up to the most advanced magazine, can be worked under different systems according to circumstances: these are direct convoys, staging, and meeting systems. In the first, large sections of the transport journey laden day after day traversing the whole of a certain distance until their destination is reached, returning the whole of the distance back unladen to receive a fresh load. In the staging system, on the other hand, the entire distance is divided as much as possible into equal parts or stages, the same section of the transport working always over the same part of the road going laden and returning unladen. The meeting system is only a modification of the staging where two sections, one laden and one unladen work in conjunction, and meet daily at a fixed point halfway, where the loads are transferred from one to the other, thus each section performs one half of the journey laden, and the other half unladen.

In direct convoys the labour of the animals is continuous. In the Khiva, and in the two Afghan campaigns, for example, the mortality in camels was immense, owing principally to their being worked on this system, marching loaded for a number of consecutive days without a halt or the comparative rest which is ensured to them in the staging system by returning without a load every other day.

In the first advance an army must be accompanied by large convoys, for a staging system requires a certain time to arrange. As this latter system demands the goodwill of the inhabitants and immunity from attack and annoyance, both for the transport in transit and the stations on the line of communications, well guarded convoys are preferable where the line of communications passes through a very hostile and difficult country.

Transport by direct convoys is necessary where a large number of wounded have to be removed after a battle, where a flank movement of the army necessitates a change in the line of communications, or a retreat the hasty removal of magazines. As a rule, however, the advantages of the staging over the direct convoy system are so palpable as to recommend its employment in preference to the latter on all other occasions.

If the troops were allowed the transport necessary to carry what they would need for the entire duration of an expedition they would have an unmanageable quantity, difficult to guard when in camp or out grazing, and embarrassing on the march; and the further the army advanced the larger the portion would become that had completed the work for which it was originally intended. To limit these drawbacks a staging system is considered desirable, by means of which the transport can be more economically worked, the supplies and *matériel* being pushed forward through the agency of the communications staff, step by step in small columns from one stage to another. *Dépôts* and magazines are thus formed, the troops not being advanced until, a certain accumulation of supplies and stores having been effected, no risk is incurred of falling short of what they need.

It would be a saving of labour and time, no doubt, once the carts are loaded at the base or principal *dépôts*, to send them right through to their destination without unloading and reloading at each intermediate stage, but this is only possible where the carts and cattle are both the property of Government, for to separate the owners carts from their cattle is not desirable.

With a staging system, if the troops are compelled to fall back, they fall back on established magazines, and have not to abandon a large quantity of supplies and transport. In operating from a sea base, as the supplies cannot all be landed at the same time, the staging system offers the most rapid way of commencing operations; rapidity is also secured at need, for with relays of animals on the road, a convoy can march by day and night, and accomplish two or three ordinary marches in the twenty-four hours.

The advantages of the staging system are that the drivers and animals always working on the same part of the road, on one they are familiar with, work more cheerfully and endure less fatigue. The drivers being near their own places of abode can feed themselves and their animals, and proper shelter can be provided for both. Grazing and water sufficient for the daily wants of the small number of animals kept at each stage is more easily found than when large masses are moving together. A larger quantity of provisions are conveyed in a certain time to a fixed place than is possible with direct convoys, for the unremunerative weights are much reduced. The return journey allows the animals comparative rest every other day, and where the precaution of having a percentage of spare animals is taken, a certain number each day need not quit the stables. All repairs are more easily executed, as the artificers being stationary, can devote all their time to them.

In staging operations ample supervision is necessary; the inspecting or superintending officers must move about from post to post, to see how the work is carried out, and to alter and correct any apparent defects. Veterinary Surgeons should be detailed for work on the line of communications, their professional knowledge will prove a great benefit to the transport and will be a cause of considerable saving to the public. The distances between the stages should bear due relation to the difficulties of the road; where these present serious difficulties the length of the stages should be shortened: spare animals should also be provided to help the carriages over exceptionally difficult parts of the roads. Some stages can be worked best by mules, others by bullocks, the animals for draught or pack should therefore be chosen according as they are best suited by nature for each section of the road. As the paces of different animals vary considerably, it will be found preferable in following this system to employ only one description of animals for each stage.

With the meeting system we obtain a more even distribution of work, the drivers and animals return to their respective stations every night, and the distance of the stages can be slightly increased, as half of the work performed by the animals each day will be very light. The arrangements for transferring the stores midway may present some difficulty, but with a little arrangement this difficulty may be overcome. An absolute certainty, however, in the departure of an equal amount of transport from both points is necessary; if the stations are in telegraphic or other communication this will be easily obtained.

An army advancing in a difficult and intricate country should endeavour to dispense with a large transport train, as the defence of it will employ nearly the whole of the available force. If the climate be good, tents may be dispensed with; beyond the most advanced dépôt, nothing but what is an absolute necessity of life should be carried, either by the men or by the transport: no luxuries should be permitted. The *impedimenta* should be so reduced as to be able to push them up with the column, the convoy, however, being well guarded, for attacks on it may be expected from an active enemy, who will soon discover that he has little, save hard knocks, to gain by engaging

the troops, but much to expect from attacks made on an inadequately guarded convoy.

On service, with the object of reducing the *impedimenta*, we must return to the most simple habits, and satisfy ourselves with the purest necessities. The lot of the soldier on service has always been fatigue, discomfort, and privations, so much so, that a good deal of the honour that attaches to the military is derived from the remembrance of the hardships endured and of the difficulties surmounted. It is of no use reminding our officers of the example they are expected to set to the men by cheerfully supporting the hardships of a campaign, for they do so to an amount that would rather astonish the public accustomed to see them so particular in their dress, so elegantly got up, so luxurious at their messes and clubs, and so thoroughly pleasure-seeking in time of peace.

If the enemy (as is generally the case when fighting against hill tribes and savages) marches very light, some sacrifices must be made to place one's troops on an equality with him. However, these people can subsist on the scanty resources of the country better than organised troops, whilst the habits of their life enables them to bear great fatigues and long severe marches with little food and no comforts. It should, however, not be lost sight of that their mobility is acquired at an enormous price, which is the impossibility of carrying on protracted operations, for, having no regularly organised system of supply, they cannot hold long together and must disperse for food, and, as in war the army which can stay the longest wins, they thus set aside every prospect of conquering in the end.

It is always a subject for military administrators to consider how best to reduce the difficulties of a large cumbersome transport train, and with that view the *impedimenta* of an army should be reduced as much as prudence will allow. An infantry where the men could carry all that is necessary for their requirements is much to be desired; but, as the overweighting of the soldier, with several days' provisions, a large number of cartridges, spare necessities, and a share of tent only leads to the destruction of his health, and prevents rapid marching, the load must be reduced within discreet bounds, carriages or pack animals being allotted to the troops to carry the rest. All such improvements as, *p. e.*, for infantry, the Oliver equipment, which (though unfortunately rather too complicated) allows of a reduction in the ammunition reserves, for cavalry compressed forage, forage biscuits, etc., should be adopted, after their practicability has been sufficiently tested; after all this has been done it remains to organize those *impedimenta* which cannot be dispensed with without running great risks.

What confusion must necessarily reign in a column several miles in length, of carriages of every description and pack animals of all sorts, where the want of well-defined regulations and the absence of the necessary supervision has failed to infuse order and regularity.

A proper organization of this incongruous mass will do much towards imparting order in the long moving mass of vehicles, animals, and men. Hence it is that we commence by procuring well-built wagons, powerful young animals to draw them, and serviceable harness, to prevent any breakdown on the way. We divide the whole into certain easily manageable fractions, to obtain more readily the supervision so much required. We mark every wagon, carriage, ambulance, etc., with the number of the division, corps, or branch of the service it belongs to, to help readily to recognize to what part of the army each fraction is assigned. These and such like steps are taken before the troops actually go into the field; but this is not enough, there are other important considerations affecting the transport which

have still to be taken into account, such as the position of the various parts on the line of march, the whereabouts of the same during the progress of an engagement, and the orders necessary with regard to their movements under certain circumstances likely to arise on active service.

As a general rule, the arrangement of the transport on the line of march depends entirely on the probability of an engagement. Some portions, such as the reserve ammunition, intrenching tool carts, field hospitals and ambulance wagons, will be required during the course of an action, and must therefore follow close in rear of the combatants when an engagement is imminent. When no such probability exists, then the movements of the *impedimenta* should be made subservient to the convenience of the troops, for these must have their food as soon as possible after the day's march is concluded, and after that rest. In all cases where an engagement is likely to take place, the safety of the transport train and the keeping of all the roads by which reinforcements may have to move up or troops to retire clear of encumbrances, are points demanding special attention.

The staff being well informed as to the state of affairs, from the reports of the cavalry covering the army, will be able to assign the proper place to each portion of the transport on the line of march. The orders will specify the various parts to accompany the troops with the order in which they will have to follow, the interval of time that must elapse before the remainder is put in motion, and how far it should proceed. In some cases, as for example, when an army is retiring, how long before the troops move off the transport should quit camp.

The transport train has no business on the field of battle; there it will be uselessly exposed, and will be a hindrance to the free movements of the troops, it may also seriously retard them if they have to retire or take up a position in rear.

Its proper place is far in rear of the reserves, parked and ready to follow the troops should they advance, or to precede them and clear their way should they retire. There should be always a small force detailed for its protection and the maintenance of order; for this purpose the baggage guards usually detailed and the military police should suffice. The ammunition reserves must follow the combatants as closely as possible without actually coming under the enemy's fire, and should be placed in rear of the centre of their respective corps or divisions.

The regimental reserve ammunition and the intrenching tools should always, when an engagement is imminent, march in rear of their respective battalions. These may be moved off the main road at any moment after coming into contact with the enemy, and in a wooded or difficult country the reserve ammunition and tools, once separated, might never rejoin them. When there is no chance of an engagement they would do better in the rear, all in one group, following the light baggage of each brigade.

On the regiments going into action, the regimental reserve ammunition wagons should remain in the spot chosen for binding up the wounds of the men. In this place there will be constant communication with the regiment, which will facilitate the sending forward of the ammunition as required. The field hospitals, the ambulance wagons and other sick transport must follow the troops; the first should be halted in such places as the medical officers may select as most suitable for the reception and accommodation of the wounded, the second should move still closer to the front and follow in rear of their respective corps, divisions, and brigades, ready to receive the wounded and convey them to the field hospitals.

An army may occupy a position in which it is desired to await an attack from the enemy. As the issue of the fight will be doubtful, and the troops may have to retire, the transport train should be sent to the rear betimes, and need only be moved so far back as to be easily brought up when again required. This withdrawal of the *impedimenta* must be done judiciously, not to disturb the confidence of the troops by creating a false impression that whatever may happen a retreat is intended. An army in retreat should always be preceded by its transport train; should such a movement be only contemplated on the approach of the enemy, the transport train need only be moved to the rear in such time as will allow of the roads being cleared for the columns to follow without loss of time. Should the retreat only be intended in the event of the enemy displaying superior forces, or showing a desire to bring on an action, and neither eventualities come to pass, the transport train can be made to rejoin the troops late in the course of the day.

An army may advance to attack, or it may expect to fall in with the enemy during the march, the safety of the train and the advantages of keeping the roads free of encumbrances will in such a case be best obtained by the transport train remaining parked in the last camping ground, or at some place in the rear, ready to move forward when ordered to do so.

When two armies are facing each other, one may receive large reinforcements and attack when such a movement was least expected; in such a case the attacked would have to move forward to oppose the enemy whilst the train is put rapidly in motion and removed from the field of battle. As a general rule, however, when armies are in such vicinity to each other that an engagement is likely to be brought on at any moment, it will be always prudent to keep with the troops only so much of the transport train as is indispensable; this small portion can easily be withdrawn when it becomes necessary to do so.

When an army makes a flank march in the vicinity of the enemy the transport train should conform to the movement by marching by some parallel road a few miles in rear on the protected flank.

CHAPTER III.

REVIEW OF OUR TRANSPORT IN FORMER WARS—CRIMEA, PERSIA, INDIAN MUTINY, CHINA, NEW ZEALAND, LOOSHAI, DUFFLA GOLD COAST, ABYSSINIA, AFGHANISTAN, ZULULAND.

The successes of the British army in the Peninsula at the commencement of the present century were looked upon with satisfaction and pride during the long peace that followed them, so much so, that what was done in those years appeared to have gradually become the accepted guide of what should be done should we be forced again into a war. In the matter of transport this favoured a prejudice with regard to pack transport until we became almost convinced that there was no more suitable transport for troops in the field. We lost sight of the fact that in a country so rugged and wanting in good roads, pack animals, (the transport of the country) had naturally to be used: our experience in the Indian wars, where pack transport was largely used, no doubt had also its effect in confirming this prejudice. The fact was not that that style of transport was above all others suited to the military service, as that the nature of these countries admitted of no other. We

accepted its adoption without duly considering the circumstances, and, though the other armies of Europe have proved the unquestionable superiority of wheeled carriage over pack transport in countries intersected by good roads, we have still too great a leaning toward the employment of the latter.

In reviewing the transport arrangements in some of our former wars, we shall limit ourselves in examining those of more recent times, commencing from the Crimean War, as that war may be said to have given origin to many very important alterations in the organization and armament of European armies. We shall leave out the experiences of the Peninsula, they are no doubt very instructive, but the conditions of warfare have altered too much from those days, and we can gather sufficient instruction from wars of a more recent date.

Crimean War, 1854-55.

In 1833 the Royal Wagon Train, which the Duke of Wellington originated in the Peninsula for the conveyance of the sick and wounded, ammunition, regimental baggage, and everything brought within range of the enemy's fire, was disbanded, and in the British army at home no vestige of a transport corps remained. When the Russian war broke out in 1854, and a British force was sent to Bulgaria, there was no transport for it. No provision either was made in England for the equipment of a transport corps at the commencement of the war; pack-saddles, bridles, picketing materials, clothing etc., all had to be purchased in the best possible way at Constantinople. On the expedition proceeding to the Crimea, sea transport not being available for about 5,000 horses, draught cattle, and buffaloes already collected, only seventy five mules and a few Maltese carts were landed in that country with the troops. The land transport the British army had to rely upon until a base was established at Balaclava was totally inadequate to its wants: we borrow Kinglake's words to show how most of this was obtained. Referring to a convoy of arabas, which luckily fell into the hands of the British soon after landing, he says: "The Cossacks tried hard to save the convoy by using the points of their lances against the bullocks, and even against the drivers; but, the Fusiliers advancing and beginning to open fire, the Cossacks at length retreated, leaving Airey in possession of just that kind of prize which the army most needed. Never ceasing to think it was vital to have more and more means of transport, Airey afterwards dispatched the officers of his department in all directions to bring in supplies. Sending Captain Sankey to Tuzla and Sak, he thence got 105 wagons. Sending Captain Hamilton to Bujuk Aktash, to Beshi Aktash, to Tenish, and Sak, he got 67 camels, 253 horses, 45 cart loads of poultry, barley, and other supplies, with more than 1,000 head of cattle and sheep. At a later date, and when the army was moving, he took 25 wagons from a village near the line of march. One day, moreover, it happened that Airey sent his Aide-de-camp Nolan to explore for water, and, though he was without a cavalry escort, Nolan boldly cut in upon a convoy of 80 government wagons laden with flour, and seized the whole of it. In all some 350 wagons were obtained, with all their teams and with their Tartar drivers."

During the severe winter of 1854-55, when the Commissariat arrangements for transport were found to have failed, a Land Transport Corps was raised by a Royal Warrant of the 24 January 1855. This corps was a regularly organised body, principally officered by well conducted non-commissioned officers taken from the regiments serving

in the Crimea, and was gradually augmented during the progress of the campaign.

At first our Consuls abroad were appointed as agents for the purchase of the large quantity of animals required, and received a certain percentage fixed by the Secretary of State for War as a remuneration for themselves and for the payment of sub-agents and other expenses incurred previous to the delivery of the animals. These Consuls, possessing as they did a fair knowledge of the resources of the country, would have been very useful, were it not that it was found incompatible for them to absent themselves too much from their posts. Special agents, principally officers of the army, were therefore appointed for Syria, Bulgaria, Spain, and Piedmont, on fixed salaries, the salaries of sub-agents and other expenses being defrayed by Government.

With the special agents were accountants appointed by the Secretary of State for War, who, on their requisitions, paid for the purchases effected, checked accounts and pay lists, and corresponded with the chief accountant, from whom they received instructions regarding the keeping of accounts and the money transactions of the agency. The agent arranged for the pay and subsistence of the convoys sent to the reserve depôts, and reported all transactions to the head of the transport department in the field.

Money was obtained by a Warrant on the Treasury chest, signed by the commander of the forces, the head of the transport, and the chief accountant. On this warrant the Consuls or special agents' accountants negotiated bills upon the Treasury chest; where this was not feasible bills were drawn upon Her Majesty's Treasury direct.

Animals were purchased at Diarbekir, Trebizond, Bagdad, Erzeroum, Samsoun, Bucharest, the Dardanelles, Antioch, Aleppo, Damascus, in Syria, Bulgaria, Spain, and Piedmont. Two depôts were formed for their reception, one in the Dardanelles for all animals coming from Spain, Piedmont, Sicily, and the Archipelago; the other at Sinope, for those drawn from Asia Minor.

By the beginning of 1856, 28,000 horses, mules, and camels had been obtained for the prosecution of the war in the spring. The Director of the Transport reported that it was found that the most efficient agents for the purchase and hire of transport were the combatant officers employed specially on that duty.

The Land Transport Corps worked entirely in the Crimea; at Scutari and other places in Turkey where we had troops, the Commissariat continued in charge of the transport.

Notwithstanding the hurried way in which the corps was organized, and the extremely raw material of which it was composed, it worked exceedingly well; unfortunately its efficiency and working could not be thoroughly tested as the British Army in the Crimea was stationary, and the duties of the corps were confined to bringing up stores, supplies, and *matériel* from Balaclava to the various divisions and depôts at the front.

At the conclusion of the war the strength of the corps was much reduced, and from it was formed the Military Train. A portion of this corps was engaged in India during the mutiny (where the want of mounted troops caused it to be employed as light cavalry), in China, in New Zealand, and Canada: on the formation of the Control Department it was divested of much of its military character, and was turned into the transport companies of the Army Service Corps, (now Commissariat and Transport Corps).

Persian War, 1856-57, and Indian Mutiny, 1857-58.

These wars soon followed the Crimean War; in both the transport was organized according to the Indian scale of requirements, pack animals, camels, and mules being principally used, wagons and carts being generally reserved for ordnance stores. A review of the old Indian transport arrangements, where the animals and followers were always out of all proportion to the force sent into the field, where no special organization or sub-division into regular fractions was introduced, and where the transport was of a purely civil description, will not be attempted; first, because it has been acknowledged by the best judges to be very defective; secondly, because wars in the plains of India are now exceptional, and the introduction of railways have greatly altered the transport system of the country. Indian armies are followed by a confused mass of baggage animals, and followers, extending for a long way in rear of the troops; the sketches sent home by the correspondents of illustrated papers convey a good idea of the confusion of an Indian baggage column, where elephants, camels, bullock carts, mules, and ponies are seen all moving together in a mixed and confused mass.

Sir J. Adye, in his remarks on transport in India, observes: "The transport required for food, ammunition, medical stores, clothing, and the hundred details which go to meet the almost artificial wants of modern armies, render rapid locomotion nearly impossible, and our Indian experience has hitherto been very adverse to light equipment. For a century past, indeed, our troops have wandered slowly and wearily over the interminable plains, followed by long lines of elephants, camels, bullocks, and carts, transporting huge tents, together with tables, chairs, bedsteads, carpets, crockery, and many other unwieldy and unnecessary items of officers' and soldiers' equipment; and to these *impedimenta* must be added the hordes of native followers, who, far outnumbering the fighting men, have been, and still are, the invariable appendage of our Indian army."

According to the Indian regulations, carriage at the rate of 40 lbs. is provided for each non-commissioned officer and soldier proceeding on service, and 10 per cent of the private followers are allowed to accompany the troops. The sick carriage for European troops is calculated at 5 per cent. of the strength, and that for native soldiers at 1 per cent. The large amount of transport which accompanies our armies in India is partly indispensable to carry the large and heavy tents required to thoroughly shelter the European soldier in that very hot country, many animals are required to carry his kit, and by the employment of native servants he is saved many duties, which, by exposing him to the burning rays of an Indian sun, would soon undermine his constitution.

To see how the Indian transport is capable of being turned into an organized and orderly body, we have only to look back to the days when Sir Charles Napier was commanding in Scinde. In 1844-45, Sir Charles was operating in Cutchee, a most wild and difficult country, and, though his fighting men did not amount to more than 5,000 men, "no less than 20,000 persons, and their innumerable animals, were to be provided for, and handled amidst those barren rocks" (Sir C. Napier's *Administration of Scinde*). To guard against the baggage being any longer a confused host of men and animals, and principally to provide against desertions, disorder, and the breaking down of the finest combinations which invariably occurred when the baggage animals were hired, and the drivers undisciplined, he introduced a military organization of his transport.

He divided the camels into divisions of 600 each, the animals being the property of Government, the drivers enlisted men, disciplined, armed and drilled as soldiers, and commanded by regular officers. The men were clothed in uniform, and each division had a special colour, and a directing animal on which was carried a flag by day, and a lantern by night; the flag, the light, the trappings of the camels, and the uniform of the drivers of each division all corresponded in colour. The animals were classed as strong and weak, and bore round their necks tablets to show the maximum load each one was intended to bear. One driver was given to each animal, but, with each three camels, one driver led the animals the other two formed the escort. The camel corps was under the command of a superior officer, and in case of attack, instead of the baggage animals pressing in a confused mass on the troops for protection, they formed rings or squares, the animals kneeling down with their heads inwards, the drivers under shelter of this living redoubt driving off the assailants by the fire of their carbines.

In Scinde, Sir C. Napier was operating in a country teeming with armed robbers and most daring freebooters; by this organization he obtained increased mobility for his army. The baggage corps by providing its own escort gained several advantages; it maintained the effectiveness of each corps at their proper strength; saved the troops being fatigued by having to march in the dust at the slow pace of baggage animals; the drivers, not being all required to take the animals out to graze, obtained rest alternately; being armed and led, they did not desert on the first appearance of danger, and the General was relieved of any apprehension regarding the safety of his baggage train. This organization, introduced by Sir C. Napier, was revived when the Bombay column under Sir D. Dundas (better known later as Lord Melville) was dispatched to co-operate with the troops besieging Mooltan, but was objected to by the Indian Government on the score of expense, and afterwards discontinued.

The Persian war was of very short duration, and the transport required for the troops had not all been provided when the war suddenly terminated. In the Indian Mutiny the old contract system under commissariat arrangements provided what was needed; there was no scarcity of forage, the country was open and well suited for transport by pack-animals, still, at the very commencement of the rebellion, in May 1857, a rapid advance on Delhi, by which the progress of the insurrection might have been stifled, was impossible owing to the requisite quantity of carriage not being procurable. Sir H. Rose in a report to the Quartermaster-General of the Bombay Army, No. 131 of 1860, dated 9th January, 1868, describes the difficulties and delays which occurred in organizing the Central Indian Field force, all of which he attributed to the unorganized hired transport. The conditions of our Indian territories have considerably changed since 1857, the introduction of railways (except in operations carried over the frontier,) has greatly facilitated the moving of the troops and their *impedimenta*.

China War, 1860.

The land transport for the force sent to China had to be entirely formed; it was placed under the control of the Commissariat, officers being dispatched to Singapore, Japan, Manilla, and the Chinese treaty ports to make the necessary purchases of animals. Bullocks were obtained from Madras, and about 600 trained mules with their drivers came from Bombay and proved by far the most efficient part of the transport. A train composed of about 2,500 animals and 2,000 drivers was organized, being divided into three brigades, officered and

superintended by the battalion of the Military Train which formed part of the expeditionary force. The drivers came from India, China, and Manilla, each man having, as a rule, charge of three animals. A number of waggons and Maltese carts were supplied from Woolwich, but were found to be of inferior quality.

No animals were to be obtained at Singapore; the ponies purchased in Manilla were under-sized, weedy, and unfit for baggage purposes; sturdy and excellent Shantung ponies were obtained from Shanghai; two or three thousand horses were purchased in Japan, but very few were taken out of the country for want of sea transport: the war came suddenly to an end, and a large number, which cost Government 25 dollars a piece, were eventually resold for 5 dollars each. The ponies bought in Japan were inferior, both in build and strength, to the Shantung ponies, but fiery and of good blood. The Bombay mules, notwithstanding a three months' journey by sea, were landed in excellent order. The Indian pad, as was the case later in Abyssinia, was found very good. Want of care in shipping and looking after the ponies at sea was the cause of much mortality amongst them, and of large numbers being landed in a wretched state and quite unfit for work.

The plan of employing the men of the Military Train each to look after 10 drivers and 30 animals was found in practice not to have worked well. The private soldier does not possess the tact so much required when working with natives, and a superior stamp of man than what is generally found in the ranks is required to assume suddenly the supervision of a number of men and animals. The Military Train men were unable to converse with the drivers placed under their orders, and it was considered that native superintendents would have proved more efficient.

Besides the above train, a corps of Chinese carriers, about 3,000 in number, was raised at Canton by Major Temple for the transport of the munitions and stores of the army. The corps was divided into companies, commanded by officers of British and of Indian regiments, superintended by non-commissioned officers and native headmen, these last also acting as interpreters. The carriers received as pay, 9 dollars (17s. 6d.) a month, and were supplied with rations and two suits of clothes. The coolies were dressed in Chinese jackets and loose trousers, the feet being left bare. On the jacket, both in front and on the back, within a black circular line, was inscribed the number of the carrier, and underneath it, separated by a black line, that of his company. For head-dress, they wore bamboo caps with the letters C.C.C. (Canton Coolie Corps) painted in front.

The scum only of the population of Canton enlisted as carriers, for a rumour had spread about that the men were to be thrust forward to receive the brunt of the battle, whilst the British, sheltered behind them, would fire away without danger to themselves. The fearless conduct of the Coolie Corps at the attack of the Takoo Forts excited the admiration of the troops, but, being composed of thieves, pirates, and the lowest of the population, they could with difficulty be kept from plundering and committing mischief. The coolies used to slip away from camp and prowl about the neighbouring villages in search of plunder, and otherwise misconducted themselves, until at Tung-chow the General had one of them hanged as a warning to the rest.

The road by which the troops advanced up to Tang-chow, about 14 miles from Peking, lay near the bank of the Peiho, navigable throughout for junks of small draught, of which hundreds were to be found at Tien-sin. Boats with 15-inch draught could come up in five or six days, returning in three. Water transport was neglected, until

the land transport had been found utterly insufficient, and, when it was utilized, as some of the junks used drew 18 inches, these made longer passages than would have been made by smaller boats, and met with difficulties.

The country was very favourable for military operations. Forage for horses and transport animals was everywhere abundant—so much so, that between 3,000 to 4,000 animals subsisted for 14 days on the forage found within the pickets. The horses became accustomed to and thrived well on Indian corn and millet seed; indeed, between the months of August and November, a large force of cavalry may take the field in the valley of the Peiho without any assistance from the Commissariat.

Between Taku and Pekin carts drawn by mules and ponies are everywhere abundant, they are drawn by four mules or ponies, one in the shafts and three abreast in front as leaders. The mules and ponies of the country are fine and strong, and well adapted for draught. In the valley of the Peiho these are numerous, and at Pekin are also found strong sturdy carriers. One special description of carriage generally used throughout the country remains to be noted; this is a large wheelbarrow, principally employed in and about large towns, one carrier, sometimes two, act as leaders; each of these wheelbarrows can carry a load of 240 lbs.

New Zealand War, 1861 to 1865.

The China war had no sooner been brought to a successful termination than troubles broke out in our colony of New Zealand, and a transport had to be provided to enable the troops to commence operations against the Maoris.

At the commencement of this war, which lasted from 1861 to 1865, there was no organized land transport in the country, and Deputy Commissary-General Bailey, the same officer who had the direction of the land transport in the North China campaign, was called upon to organize one. We were fortunate in securing on this occasion the services of an officer who had in a very recent campaign obtained great experience in this branch of the service. It is needless to say that under such an officer, in whose mind the shortcomings and defects noticed in the former campaign were still fresh, the organization and working of the transport could not fail to become vastly improved.

The formation of a transport corps was approved of in June 1861, and it was called the Commissariat Transport Corps. At first it was arranged to raise two companies, each of the following strength, viz.: 1 officer, 1 staff-sergeant, 5 sergeants, and 100 privates as drivers, each private to look after two animals. The men were raised from the British troops and Colonial militia, receiving extra pay at the following rates: officers, 9s. 6d. per diem; sergeants, 2s. 6d.; privates 1s.

Other companies were formed as reinforcements arrived, until, towards the close of the war, the strength of the transport corps amounted to 41 officers, 125 non-commissioned officers, and 1,341 men, with 1,516 horses and 728 bullocks. A battalion of the Military Train arrived in the country towards the end of the war, but the transport continued to remain in charge of the Commissariat. It would have hardly been judicious, after three years' experience had imparted a certain degree of efficiency to the transport, to have transferred its direction to an officer who had just arrived in the country. The Lieutenant-General Commanding in New Zealand, in stating his reasons for keeping the Military Train and Commissariat Transport distinct, says: "I believe that if the two corps were amalgamated contrary to the expressed opinion

of the Deputy Commissary-General, any failure or irregularity in the supply of the troops in advanced positions might possibly be attributed to the want of direct control over the transport."

To obtain the necessary transport animals for the first two companies, 100 pack horses were ordered from Sydney, 50 horses for pack (at a maximum price of 20*l.*), and 25 for ambulances were purchased in Auckland, where 30 double draught animals, and 450 pack-saddles were also contracted for.

Bullocks were purchased on the spot in Taranaki and Auckland, the purchase of horses and bullocks at the latter place being entrusted to a board of officers. Owing to pleuro-pneumonia prevailing in the country, a large number of bullocks perished during the war.

Lieutenant-Colonel D. J. Gamble remarks on the bullock transport as follows (Head-quarters, New Plymouth, June 6th, 1863): "With regard to transport, I would observe that the bullock transport of this province cannot be surpassed in suitability to the nature of the country. A light, handy dray, capable of conveying half a ton, is drawn by four or even two bullocks. These carts will keep tolerably well with the ordinary pace of a column, and are in fact the only kind of transport to be relied on for communication in this country during winter months, when deep ravines and rivers have to be crossed, and unmetalled roads, cut up by traffic and rains of tropical force, have to be traversed."

A certain portion of the transport during this war was performed by water. The depth of water up the rivers was, however, very small, and rowing boats to carry 10 to 12 tons, drawing only two 2 feet of water, had to be purposely built. Two companies of boatmen were raised for this service. The water transport met often with obstructions, on one route alone the supplies had to change the mode of conveyance eight times over a length of 111 miles.

A pack-saddle from the Cape was at first used in the transport, but it was not found to answer as it gave a number of horses sore backs; the Otago saddle was substituted for it with good effect. The carts of the country were also found preferable to those supplied by the Military Store Department.

Expedition to Looshai, 1871-72; Duffla, 1874-75; and Gold Coast War, 1873-74.

The expeditions to Looshai and Duffla, in India, and the war on the Gold Coast of 1873-74, afford good examples of transport done principally or entirely by carriers. In the the two first, the country in which the troops moved was hilly, in the third, with the exception of the Adansee Hills, it was quite flat; the roads, however, in all three led through dense forests, and in the latter case, from Cape Coast Castle to Coomassie, a distance of nearly 180 miles, there was hardly a clear space of a few acres to be found.

In Looshai the success of the expedition was risked by the Indian Government directing a large portion of the transport to be given over to the control and management of the Commissariat. The officers of the Indian Commissariat attend, as a rule, to both the supply and transport branches, and the Quartermaster General (of India), in a letter to the Secretary to the Government of India, Military Department, remarked in this instance, with regard to this arrangement, as follows: "The Commander-in-chief considers that the ordinary Commissariat superintendence is not sufficient to provide for the economical use and employment of the carriage, whether it consists of coolies or elephants, and

that this carriage should be regularly organized with a sufficient staff of officers and subordinates."

General Bouchier, commanding one of the columns, in a report to the Quartermaster General, says: "I have acted directly in obedience to the orders of Government in making over the whole of the Commissariat coolies (about 4,000) to Colonel ———* I have done so under the positive orders conveyed to me, but utterly contrary to my own convictions. Instead of acting in an administrative capacity, Colonel ———'s time is taken up running about from station to station trying to find out where the coolies are. On arrival in camp there is no one to look after them; and from the Commissariat officers being employed on duties alien to their legitimate position, I never can find out what Commissariat stores are to the front, or how many day's supply I may depend on, or how far I can with safety move.

"In fact, I am, as far as military movements are concerned, at the mercy of the Commissariat, who have, with the exception of the coolie corps, complete command over the carriage, which they use as they, not I, think best, and regarding whose whereabouts or efficiency I cannot get a report out of Colonel ———, although he has frequently been called upon for the information I require."

In the other column the Commissariat officer expressed his wish to the General Commanding not to be put in charge of the coolies, as the Commissariat Department being already overworked, could not be expected to undertake the management of 1,400 coolies over such a long line of operations.

In the Duffla Expedition the coolie corps was kept intact as one body, with its own organization, under the command of a colonel in the army, and provided transport for all the wants of the force; this organization was found to answer well.

On the Gold Coast a supply officer of the Control Department had at first the charge of raising and directing the transport, but, later on, its direction was transferred to the officer in charge of the line of communications with an adequate staff of special service officers to assist him.

Lord Napier proposed the following organization for each division of the coolie corps for Looshai—

- 1 European officer.
- 1 Assistant.
- 4 1st class subordinates.
- 20 mates.
- 300 men.

In the Duffla Expedition the corps consisted of four divisions, each division as follows :—

- 1 European officer.
- 3 non-commissioned officers.
- 12 sirdars or mates.
- 300 men.

divided into three companies of 100 men under a smart non-commissioned officer with a sirdar or mate for each section of 25 men.

On the Gold Coast there was no special organization and the strength of an officer's charge varied very much.

From *A Narrative of the Expedition to Looshai*, by Lieutenant-Colonel, now Lieut.-General, Sir F. Roberts, V.C., G.C.B., we gather the following information regarding the organization of the coolie corps.

* One of the Commissariat officers with the Cachar column.

The monthly pay of the corps was fixed at 8 rupees for carriers, 10 for mates, 12 for sirdars (headmen). The men came from the Punjab, Lucknow, Cawnpore, Allahabad, Chota Nagpore, and the neighbourhood of Darjeeling. None were entertained under 20 or over 40 years of age.

They were engaged for a period not exceeding eight months. The men received free rations on the scale allowed for camp followers, and an advance of one month's pay on enlistment, afterwards being allowed to make family remittances. In case of death the man's family was to be allowed a gratuity of three month's pay.

Each man was supplied with 1 blanket, 1 blanket jacket or loose coat, 1 pair of shoes, 1 pair of socks, 1 pair of cloth leg bandages, 1 havresack, 12 feet of good stout cord, 1 dhao or kokery, 1 water-proof sheet for every two men. The last two articles were to be returned into store at the completion of the service.

The load carried, besides the man's own kit, was not to exceed 20 seers (40 lbs.). The weight of the kit was as follows :—

	lbs. ozs.
Blankets	7 0
Waterproof sheet	4 8
Cooking pots	4 0
Dhao.	1 12
Havresack with a day's ration, etc. ..	4 12
	<hr/>
	22 0

The total weight carried was therefore about 62 lbs., which is a severe load for a man to carry day after day in a hilly country. Still, to keep the men in health, none of these articles of kit could be well omitted.

For every 600 men there were :—

- 1 Native doctor.
- 1 Goomashta.
- 2 Moonshes (writers).
- 6 Headmen.
- 24 Mates.
- 9 Havildars, Naiks or intelligent Sepoys.

The weight of stores carried by transport men in the Looshai and Duffla expeditions was about 40 lbs., but in the China and Gold Coast wars it was fixed at 50 lbs., though many of the loads never actually came up to the weight fixed. In the Gold Coast one carrier was allowed to each regimental officer and one for the kit of every three European soldiers. The small 7-pounder guns were dismounted, the piece, slung on a stout bamboo cane, was carried by four men; one carrier was allotted to each wheel and three to the gun-carriage. The ammunition was packed in small cases, each case a load for one carrier. With rockets one carrier was detailed for the rocket tube or trough, and one for each bundle of six rockets. The soldiers of the 2nd W.I. Regiment, those of the native levies and the kroomen from the men of war were employed for a long time in duties of fatigue, carrying provisions and ammunition to the front.

Abyssinian Expedition, 1867-68.

The Abyssinian expedition ranks with the Crimean War in the magnitude of the transport arrangements. The troops had to march 380 miles to Magdala, over a country entirely destitute of provisions, and on roads very trying both to man and beast. Most ample details of everything connected with this expedition are to be found in the account

of it written by Major Holland and Captain Hozier, from which the following particulars have been borrowed:—

Instructions were sent by telegraph from England as early as the 31st July, 1867, directing the collection of animals for the expedition to be set on foot in Bombay.

It being deemed impossible to obtain the large number of transport animals required entirely in India, steps were taken by the Secretary of State for India for purchasing mules in Spain, Italy, and Turkey. To Colonel Clarke-Kennedy, of the Military Train, was assigned the direction of the arrangements for obtaining mules north of the Isthmus of Suez, and purchasing officers, assisted by Veterinary Surgeons and Commissariat officers, were sent to Alicante, Valencia, Barcelona, Majorca and Minorca, Piedmont and Genoa, Smyrna, Scanderoun, Antioch and Aleppo, Tyre Sidon, and Beyrout, Samsoun and Trebizond, to make the necessary purchases. These officers received 3*l.* 3*s.* per diem, in addition to the pay of their rank, to cover all extra expenses: those ordered to Italy and Spain received an imprest of 50*l.*, those to the Levant of 100*l.*

The general officers commanding at Malta and Gibraltar were requested to have mules purchased in the vicinity of their commands, whilst Consuls and others were authorized by the special service officers to purchase for the Indian Government, receiving a 5 per cent commission.

Colonel Clarke-Kennedy established his head-quarters at Alexandria, and formed a dépôt there, and a second one at Suez. His arrangements did not go further than Suez; steamers chartered by the Bombay Government were sent there to embark the mules and convey them to Abyssinia. To assist him in his duties were attached to him 8 officers and 26 non-commissioned officers of the Military Train, 2 Commissariat officers and a Veterinary Surgeon. The Commissariat officers made all the arrangements for foraging and maintaining the muleteers and mules at the two dépôts in Egypt.

The Admiralty chartered seven steamers for the conveyance of the mules to Egypt. Each steamer was supplied with head-stalls, compressed forage, and a steam hoist for embarkation. A Veterinary Surgeon was on board of each to take charge of the animals on the voyage and to hand them over to the officer commanding the dépôt at Alexandria.

Mules were to be inspected and passed by the Veterinary Surgeons, and none bought under four years of age; each animal was to be branded on one hoof and on a flank as soon as possible after purchase. Attendants at the rate of one man for eight mules were to be engaged, to remain in Egypt for one month, after which they were to be provided with a free passage to their homes. Headmen were put in charge of 20 men. The pay of these latter was fixed at 3*s.* per diem, besides rations or compensation in lieu thereof; of the muleteers at 1*s.* 6*d.*, free rations on board ship, or 9*d.* in lieu thereof on service. Each man on engagement received a printed card signed by Colonel Clarke-Kennedy; this card had blank spaces for future entries to be filled in by the officer who engaged him, who signed across the card any promotion or reduction. A numerical roll of these cards was kept and all payments were entered on each, specifying the date of such payments. Each man wore a numerical metal badge, the headmen wearing one likewise, though of a different metal.

By the 6th November, 1867,—otherwise in about a little over two months—Colonel Clarke-Kennedy reported having completed his purchase of 8,000 mules. The order in which the following places are given shows the relative adaptation to the service of the pack animals

purchased: Cyprus, Brindisi, Malta, Cairo, Smyrna, Gibraltar, Alicante, Valencia, Scanderoon, Beyrout.

Colonel Clarke-Kennedy considered that he would be able to obtain about 2,000 mules from Syria, delivered at Cairo for 25*l.* each, and he actually purchased 250, which were delivered at Suez for 26*l.* 10*s.* The railway fare for mules from Alexandria to Suez was fixed at 33*s.* per mule, including attendants. The principal purchases appear to have been made in the following order: Gibraltar, Smyrna, Beyrout, Valencia, Alicante, Cyprus, Scanderoon, Malta, Italy.

The total number of animals received by the Abyssinian transport train from Suez amounted to 10,045 mules, 1,302 donkeys, and 741 camels.

The efforts for purchasing a sufficient quantity of animals were not confined to the north of the Isthmus of Suez; agents were also sent to effect purchases in the Persian Gulf and in Arabia, and an order was issued to purchase mules in the Punjab. From Bagdad and Bushire 1,588 mules, and 334 ponies were sent to Abyssinia. Most of these animals were conveyed to Bombay in native boats, the average price of each mule being 124½ rupees, to which sum 50 rupees were added for each animal delivered alive in Bombay. In the Punjab mules and yaboos (strong load-carrying ponies), were ordered to be purchased for the expedition at 225 and 150 rupees each respectively;* two depôts were formed for their reception, one at Rawul Pindee the other at Lahore. The total number of animals obtained from the Punjab amounted to 2,641.

In Abyssinia the drivers from the Punjab were found to be the best of the whole employed during the expedition, and the Muzbee Sikhs the strongest and most enduring men; in the Duffla expedition the Muzbee Sikhs and the Punjab Cahars were the best amongst the carriers.

Forty-four elephants were shipped at Bombay for Abyssinia. These animals proved a great acquisition to the force and were mostly used in conveying artillery.

Sir Robert Napier wished to organize a land transport corps under the Quarter-Master General, removed from the control of the Commissariat, as he considered that the ordinary Commissariat superintendence was not exactly what was required for the efficient working of a corps of such large proportions. He proposed to entrust its direction to Major Warden, an officer who had served with the Land Transport in the Crimea, and with that end in view caused him to prepare what he considered would be a desirable organization for a transport corps.

The proposed organization, when submitted to the Bombay Government, did not meet with the approval of his Excellency the Governor, who, accepting the recommendations of the Committee on the Administration of the Transport and Supply Departments of the Army of 1867, disapproved of the transport being placed under other authority but that of the Commissary General and found the organization proposed by Major Warden too elaborate and complicated, with an unnecessary subdivision of the whole transport into divisions.

Sir Robert Napier was obliged to abide by the decision of the Civil Government, but insisted on a complete organization, principally on the score of the mixture of races amongst the drivers. The Government, however, considered one European officer capable of looking after 1,000 animals, and the whole transport divided into troops of 100 mules, each troop under a native officer, to be all that was necessary. On the 12th September, 1867, a Government resolution placed the Land Transport

* The maximum price paid for the same animals when the expedition to Bhootan was being prepared was, for mules 180 rupees, for yaboos 120 rupees.

Corps on arrival in Abyssinia under a Controller of Supply and Transport, and sanctioned the organization proposed by the Commissary General of the Bombay Army.

20,000 mules or pack bullocks and 8,000 camels were deemed necessary for the force, and 14 Captains with 28 Subalterns were detailed for duty with the transport. Volunteers were called for from the non-commissioned officers and men of both European and Native corps to fill the posts of superintendents.

Besides the animals and men obtained from other sources, the following were collected in the different stations of the Bombay Presidency :—

Poona.	{	1,000 ponies.
		4,000 pack bullocks.
		1,800 muleteers.
		1,600 camel drivers.
Kurrachee.		560 dhooly bearers.
		200 dhooly bearers.
Deesa.	{	100 camel drivers.
		30 muleteers.
		200 dhooly bearers.
Belgaum.	{	50 muleteers.
		100 dhooly bearers.
Bombay.	{	300 camel drivers.
		200 muleteers.

In Abyssinia were bought 3,130 mules.

In the month of January, 1868, the state of the transport at Zula was anything but encouraging. Mules were landed without even a rope to picket them with. There being no one to take charge of them, and being consigned to no one in particular, the animals were cast loose on shore, where they roamed about in search of forage and water, and many died. At last parties of soldiers were sent to hunt them up and, by the help of long ropes, they captured most of them and took them to the dépôts.

Many of the animals on landing, particularly camels, were found unfit for work. The muleteers from Egypt misconducted themselves; many deserted, and the rest were sent back. These men had been promised warm clothing, boots, and other articles of kit, which could not be provided; they had no cooking utensils, and interpreters to communicate their complaints were wanting. Originally a bad lot, they became insubordinate, were flogged and sent away.

Confusion and disorder were brought about by insufficient officers and men being at first sent out to receive and take charge of the animals on landing, by the want of a directing head at the port of debarkation, lack of experience in working a mule train both amongst the officers and men, exaggerated reports of the supply of forage and water procurable at the place of landing, and, lastly, by the animals, drivers, and equipment being put on board of separate ships.

In the middle of the month of February the train was divided into two sections: the Highland Train, composed of the Rawul Pindee and Lahore mule train with the A and D divisions of the Bombay train was to work over 317 miles of road from Senafé to Magdala; the Lowland, composed of three divisions of mules, three of pack bullocks, three of camels, and one of carts, was to convey provisions, etc., from Zula to Senafé.

The Highland train worked well, but, notwithstanding the several reductions of camp equipment, baggage, etc., on the advance, had not the inhabitants of the country come forward to carry loads, it is

doubtful whether the troops would have reached Magdala. On the return of the force a good part of the road had been improved and made available for carts. Transport train sick animal depôts were formed 75 miles from each other, with officers charged with receiving mules and other animals, of which a great number fell sick owing to hard work with insufficient and bad fodder.

Afghan War, 1878-1879.

Some months before the outbreak of this war (on the 8th April, 1878), his Excellency the Commander-in-chief urged the Government of India to appoint a committee of officers to inquire into the question of how to provide a transport train for foreign service out of the moveable column carriage. To this request no reply being received, a reminder was sent on the 7th August, 1878, which met with no better result; a few weeks later the country was plunged into a difficult war.

On the 3rd August, 1878, the Secretary of State for India acceded to the proposal of the Viceroy to send a mission to Cabul; the mission was arrested in its progress through the Khyber on the 21st September, and hostilities commenced on the 21st November following. The time for preparations for an undertaking of such magnitude as the invasion of Afghanistan was evidently very short.

In the month of September of that year, when a war was threatening, a scheme was submitted by the Quartermaster-General's Department for the organization of a separate transport service, but the proposal was overruled by the Government who insisted that the transport should be retained under the Commissariat. The Indian Commissariat officers assumed duties they could not perform, and the result was anything but a success. Overburdened with other duties, the Commissariat Officers could not attend to the transport, every element necessary for an organized department was wanting, the animals were hastily collected, the transport officers had not the subordinate assistance so essential at all times, but principally on service, and the attendants were unaccustomed to the restraint of a regular system. Owing to these and other causes the failure of the transport service as an organization was complete. The time for preparations was too short, and the organization of the transport on a large scale was undertaken at a time when all the energies and efforts were directed to push troops and supplies to the front, in fact, after the work of transporting had actually begun, when it is practically impossible to organize.

The Commissariat Officers had not the peculiar experience needed for the management of a transport train; the department had not sufficient officers, and what there were were unable to attend to both supply and transport duties, and utterly failed in the latter. After all the claims put forward by Commissariat Officers for the undivided charge of transport and supplies, this war has given a practical proof that the best results are not to be obtained by the same officers attending to this double charge. The same result would probably attend any operations on a large scale in Europe.

Generals Sir S. Browne, Sir D. Stewart, Sir M. Biddulph, Sir F. Roberts, Sir F. Maude, Sir C. Macgregor, and other officers, have recorded that there was no organization or chain of responsibility in the transport; that the officers were new to their work, selected without requisite qualifications, and too young and inexperienced; that their duties were not properly defined, that they arrived too late to initiate any organization, and had to work with the existing one, faulty as it was, and that, in short, there was no organization worthy of the name.

We did not profit by the experience of the first Afghan war, and the very causes which in 1839 led to such an enormous mortality in baggage animals on the march between Ferozepore and Candahar were seen repeated in the second one, notwithstanding that the contingency of military operations having to be undertaken sooner or later on this theatre of war had long been foreseen by all officers with Indian experience.

In 1839, the army had marched from the Indus to Candahar without meeting any opposition on the way, still it suffered severe privations and an immense loss in stores and baggage animals. It is related that between Ferozepore and Candahar the loss of animals amounted to no less than 20,000. All through the operations in Afghanistan during the first war, the large number of transport animals we had, most of which were ill-suited to the climate and too slow of movement, were a serious hindrance to our army. The principal causes which affected the health of the baggage camels (the bulk of the transport animals) were overloading, want of sufficient rest, insufficient grazing for the large quantities of animals employed, and, after a long march, too short a time available for the animal, who is a slow eater, to graze sufficiently.

Camels in both Afghan wars were principally used for transport, as the grazing of the country was supposed to provide most easily their food. The following paragraph from Major Hough's account of the first war explains partly to what causes the immense loss in baggage animals at that time were due.

"We were obliged to carry our supplies, not getting a day's supply on the road. If we had entered the Pass (Bolan) with fresh cattle or animals not jaded after a march of 833 miles from Ferozepore, 1,038 from Kurnal, indeed some of the cattle had marched nearly 1,200 miles, the animals would not have been so knocked up; but they were worn out by a long march, bad water and want of food, and, therefore, our loss was very severe, and those remaining had strength only equal to the carriage of half loads. As the Rewaree camels (of which class they chiefly were) are not fed on grain, it will be readily imagined what numbers would die on a march where their food was to be derived from a barren country."

In 1878 the conditions were not much altered, the time for making preparations, which on account of the barren state of the country required to be made on a large scale, was insufficient; transport animals had to be collected in a hurry with no particular selection, and some were worked very young; one instance has been mentioned by Veterinary Surgeon Steele, who, at Quetta, "found 26 out of 70 dead camels only two years old!" Veterinary Surgeon Oliphant, in his report to the Principal Veterinary Surgeon in India, referring to an inspection of transport animals made at Peiwar Kotal, says, "The whole of the baggage animals of all classes thus inspected, amounted to 5,754, of which 2,326, or over 40 per cent., were physically unfit for the work required of them, showing conclusively, I think, the necessity for more skill being used in the selection." The loss in animals during the first phase of this war was very heavy, and made itself much felt when, after the destruction of the Envoy and his party, operations had to be rapidly resumed to inflict quick punishment on the offenders.

Some idea of the casualties in camels can be formed from an inspection of the following detail of carriage employed with Kuram Field Force:—

HIRED CAMELS.					Shera Singh.	Umballa.	Khuttaek.	Totals.
Brought on Rolls in October, 1878	3,190	..	992	4,182				
" " November "	2,219	..	..	2,219				
" " December "	875	..	..	875				
" " January, 1879	792	..	..	792				
" " February "	132	1,531	125	1,788				
" " March "	46	..	45	91				
" " April "	184	621	..	805				
Strayed animals recovered up to 31st May, 1879 ..	40	33	36	109				
Total ..	7,478	2,185	1,198	10,861				
CASUALTIES.								
Died, lost, deserted, abandoned, strayed, or carried off from 1st November, 1878, to 31st May, 1879	6,083	1,600	1,145	8,828				
.. Balance on rolls on 31st May, 1879 ..	1,395	585	53	2,033				
GOVERNMENT CAMELS.								
Brought on rolls from 1st March to 31st May, 1879	..	..	..	3,088				
Died, abandoned, and strayed up to 31st May, 1879	..	..	..	777				
Balance on rolls on 31st May, 1879 ..	..	..	..	2,311				
ABSTRACT.								
Total actually brought on rolls, recoveries being deducted—								
Hired camels .. ..	..	..	..	10,752				
Government camels .. ..	..	..	..	3,088				
Total .. ..	..	..	..	13,840				
Actual losses during campaign .. ..	..	..	..	9,496				
Total camels on rolls, Kuram Field Force, 31st May, 1879 .. ..	..	..	..	4,344				

The mortality in camels principally arose from want of proper selection, system, and care, also from starvation, cold, and hard work, the animals having often been kept under a load for an unnecessary length of time. Transport animals were often bought by committees and condemned by fresh committees on reaching the front; others were not of mature age; and the saddlery was badly fitted. In pack transport nothing but constant practice will ensure loads being properly made up and evenly distributed; in European regiments there was great absence of knowledge in packing, and less care in the feeding of baggage animals than in the frontier force regiments in which the animals were better looked after, the men being more accustomed to this work. Thus we read in one of Sir F. Roberts' reports: "Convoys from below arrive as a rule in good order, but the animals which come with regiments or drafts almost invariably contribute largely to the number of sore-backs in hospital." Insufficient and inefficient drivers was another of the transport difficulties. Hired mules and ponies on their return to India after the first phase of the war were found to be in better condition than the Government animals which had been handed over to regiments, because the first were tended by their owners, who were experienced men, and the latter by coolies, entertained haphazard, who stole

the grain, did not care if the animals were galled or not, and were unmanageable.

The loss in camels in the first Afghan War was reckoned at 26,700 animals; in the first phase of the last, with an exceptionally mild winter, the losses were enormous. Mr. Charles Williams, in his pamphlet, *Notes on the Operations in Lower Afghanistan*, 1878-79, says ". . . . in the opinion of able civil authorities one-third of the whole available beasts of burden in Scinde were destroyed in less than three months. Putting aside entirely the value of the animals to make good, this is a serious loss which cannot but affect the prosperity of that country for several years to come."

The second invasion of Afghanistan was carried out on three distinct lines, the Khyber, the Kurram, and the Bolan. Separate arrangements had to be made for the transport of each column. At first starting the transport was under Commissariat control with no special organization, but soon its unsatisfactory state made it necessary to have it placed in military hands, and a special organization was thus gradually introduced. The organization on the Bolan route being the most complete of the three, and there being ample detailed reports of the work undertaken, it becomes possible to give a brief narrative of the same.

In the month of February, 1879, the lower portion of the line of communications of Lieutenant-General Stewart's Army Corps at Kandahar, with its base at Sukkur, on the Indus, was placed under the direction of Brigadier-General Phayre. The transport of supplies in Cutchee was causing uneasiness, and the hand of an able administrator was necessary to save it from a thorough breakdown. The Brigadier-General received orders to store six months' supply of food for 30,000 persons in Dadur and Quetta before the 1st May, 1879, as a measure of precaution, for the transport of supplies would be entirely stopped in the intense hot season prevailing in Scinde and Cutchee for over six months of the year, and the roads would at times be closed by floods. This was a serious and difficult operation, for it meant nothing less than the conveyance of about 360,000 maunds (12,857 tons) of supplies in country carts and on pack animals, over a distance of about 247 miles, of which 59 led through the Bolan Pass, from Dadur to Sir-i-Bolan.

From Hough's account of the first Afghan War we extract a table showing the number of camels required to carry one month's supply for the army of the Indus at that period,

"No. 6. RETURN of a Month's Supply for the Army of the Indus.

CANDAHAR, 1st June, 1839.

Columns.	Fighting men.	Mustered followers.	Miscellaneous followers.	Horses.	Bullocks.	Gun Camels.	Abstract of men and cattle.	Otta or Rice.	Dall.	Ghee.	Salt.	Grain for cattle.	Remarks.
							10,406 fighting men 14,621 mustered followers	7,804	m. s. 975 23	m. s. 487 36	m. s. 162 22	m. s. ..	mta, 24,031 0 0 Dall, 3,656 22 0 Ghee, 1,170 26 0 Salt, 609 0 0 Barley 14,237 0 0
Bengal Column.	6,460	11,474	12,852	2,100	481	97	14,032 Miscellaneous followers	10,965	1,365 30	682 30	227 10	..	
Bombay Column.	3,946	3,147	1,180	1,350	..	..	3,450 horses 481 bullocks 97 gun camels	5,262	1,315 20	..	219 8	12,937	
							4 mds. per camel	24,031	3,656 22	1,170 26	609 0	14,237	mta, 4) 43,704 8 0 (1)
	10,406	14,621	14,032	3,450	481	97		6,008	914 0	293 0	153 0	3,559	Camels, 10,926 Add spare, 656 Camels 11,582

Fighting men and mustered establishments.

Otta or rice at 1 seer ea. = 2 lbs.
Dall .. at 2 ch. ea. = $\frac{1}{4}$ lb.
Ghee .. at 1 ch. ea. = $\frac{1}{8}$ "
Salt .. at $\frac{1}{4}$ ch. ea.

Miscellaneous followers.

Otta at $\frac{1}{2}$ seer ea.
Dall at 2 ch. ea.
Salt at $\frac{1}{4}$ ch. ea.

Cattle.

Horses at 5 seers ea.
Camels.. } 3 seers ea.
Bullocks }

N.B.—Thus for an army of 10,406 men, it requires $1\frac{1}{2}$ camel per man to carry provisions for one month. A cavalry soldier requires seven times as much as an Infantry soldier. The latter only wants his one seer, the former requires one for himself, one for the groom, and five for his horse. Let those who think an invasion of India an easy operation, study this Table.

(1) A maund is 80 lbs.

This return will give some idea of the size of a transport train required to convey the 360,000 maunds of food ordered to be stored for Lieut.-General Stewart's army. It should be observed that in the above return no mention is made of anything under the head of meat, tea, coffee, sugar, rum, rice, mustard, pepper, etc., which form also part of the soldier's ration. It also deserves to be noticed that, though 11,582 camels are shown as required to carry the month's provisions, no allowance is made for any food for them, part of which would have to be carried and would raise the number of transport animals in the return.

From the River Indus to the foot of the Bolan Pass at Dadur three principal routes can be made use of by convoys—

1st. From Mittunkote by the Boogtee hills, Deyra, Sungsela, etc., a distance of about 130 miles. This road, on account of the scarcity of forage and of the want of pack transport at Mittunkote, was not much used, and was abandoned on the 1st March for a more promising one.

2nd. From Sukkur to Jacobabad, 48 miles of good road, thence by Shahpoore, Poolajee, etc., 120 miles more. The supply of water on this route was insufficient for the large convoys going through, the road itself being bad and unsuited for wheel transport. It was used at first but got worse and worse, water became more scarce, and the badness of the road caused serious delays in moving the stores, until at last it had to be given up.

3rd. From Sukkur to Jacobabad, as above, thence by Burshooree, Bagh, etc., 170 miles, being well watered, with supplies procurable. This route was soon found to be the most suitable of the three; it was the one generally used by the Afghan Kafilas in their yearly journeys to and from India. It is pretty free of sandy tracts and traverses very little cultivated land. Some miles after leaving the frontier station of Jacobabad a desert tract of 27 miles has to be crossed, here all traffic by carts becomes impossible, the long journeys without water being beyond the endurance of the draught bullocks; further on it will be shown what steps were taken to overcome this difficulty.

In the month of January, 1879, a large quantity of commissariat supplies for Lieut.-General Stewart's column had been collected at the following stations:—

	Maunds.
Mittunkote	64,000
Sukkur	57,000
Jacobabad	26,000
Dadur	10,000
Miscellaneous	20,000

Total 177,000 or 6,322 tons.

The amount of supplies per mensem required for the troops in front was estimated at 45,000 maunds, about 1,607 tons.

At the very commencement of the war a large demand for carriage had been made to the Commissioner in Scinde, and from 18,000 to 20,000 camels, and 2,000 to 3,000 carts had been obtained. But the amount of stores to be moved demanded an immense quantity of carts and pack-animals. Fresh exertions were made, 3,000 camels were ordered to be purchased in Rajpcotana, and it was hoped to get an additional 2,500 from Lower Scinde; 2,000 carts were ordered to be made in Bombay, and draught bullocks were to be purchased in the frontier districts and in Cutchee. As many Afghan camels as could be obtained were also to be purchased. A large transport was required merely for supplies; other arrangements had been made for the *impedimenta*

which accompanied the Army Corps. For the Engineer and Ordnance Park and Siege Train 2,400 camels had been set apart at Sukkur, though this number was not even sufficient, and from 500 to 600 more camels were needed for this service alone.

The advantages of having alternative routes by the Mittunkote and Shahpore roads were negated by their being found quite unsuited for large convoys, and it was considered ultimately preferable to employ only the route *viâ* Jacobabad and Bagh. The first section of this road from Sukkur to Jacobabad is fair, not metalled, but covered over with thick reed grass to keep down the dust. This road lying in our territory was to be kept in repair by the Executive Engineer of the district. After leaving Jacobabad we have said that a desert tract 27 miles long presented obstacles to the transport. Arrangements were made here to bring the water of the Nari river to a point half way across this tract, thus dividing the space into two marches of 14 and 13 miles respectively. Further on parties were placed to mark out the road, to improve it and make it good enough for wheel transport. The Nari river was bridged by a trestle bridge 12 feet wide. Other parties were employed in the Bolan Pass improving the road, and bridging small streams: two companies of Bombay sappers, and the 19th Bombay Native Infantry worked in the Pass. A cart road 15 feet wide was made up the Bolan for 21 miles to Kirta, and from this a new line to Mach, about half-way between Dadur and Quetta, avoiding 5 or 6 miles of loose shingle that obstructed the wheel carriage. A large central depôt was formed at Mach (3,500 feet above the sea) where there were good places for encampments for troops, with a plentiful supply of forage and wood not far off. (*See Brigadier-General Phayre's Progress Report, dated Camp, Dadur, 1st April, 1879.*)

A salaried agent rode along the route and communicated with the Naibs and other officials of the Khan of Khelat (through whose territory the road ran) to procure assistance in labourers, supplies, transport, etc., as the superintending officers on the line needed. A medical officer was appointed as sanitary officer, huts were erected for officers and guards at the stations along the line, postal and telegraph stations were also established. Sweepers were entertained and distributed along the line for conservancy purposes. At the base at Sukkur a barrack was converted into a temporary hospital to accommodate the sick awaiting removal by rail or by river steamer, another hospital was prepared at Jacobabad, and at Kassim-ka-Joke (half-way between Dadur and Jacobabad) and at Dadur were also temporary hospitals to accommodate 25 Europeans, and 25 Natives.

The Brigadier Commanding expected, with sufficient transport, to be able to move 150,000 maunds of supplies from Sukkur to Dadur in one month. Their further removal from Dadur to Quetta was a more difficult question, for the route (which as far as Dadur lay along the level plain of Cutchee) through the Pass lay mostly in the bed of a river, over loose flints and pebbles, and was steep and trying for the animals. However, even with the most favourable calculations, it appears that not more than two-thirds of the above amount of supplies could be moved in a month. Indeed, at the time itself that the transport organization was promulgated, the number of animals fell far short of the requirements: we will not, however, stay here to inquire if it was completely carried out, for in any case the organization prepared affords a very fair example of an operation of this kind. It was not intended that the animals were to consume any of the provisions carried, but the question again, if such a country as Cutchee could supply forage for the large number of animals employed, had to be considered, for on this depended very much the excellence of the transport arrangements.

Both wheel and pack transport were to be used: 2,280 carts were made in Bombay, and 300 more were procured at Kurrachee. These 2,580 carts were to be employed on the good road between the base at Sakkur and Jacobabad, being divided into four stages as follows:—

—	Carts.	Spare.	Total carts and drivers.	Bullocks.
Sukkur	635	10	645	1,290
Mungrancee	635	10	645	1,290
Shikarpoor	635	10	645	1,290
Hunnayen	635	10	645	1,290
	2,540	40	2,580	5,160

No camel or pack carriage of any sort were to be used on these 48 miles of road. The 2,540 carts were calculated to give a daily train of 317 carts, which at 10 maunds (800 lbs.) per load were capable of conveying a total of 95,000 maunds, or about 3,393 tons. Forage and provisions for the bullocks and drivers were to be procured locally through the assistance of the civil authorities of the district.

The number of camels either present or supposed to be soon forthcoming, was set down at 7,750, and these were to be staged between Jacobabad and Dadur as follows:—

—	Camels.	Spare.	Total.
Jacobabad.. .. .	1,000	50	1,050
Nehal ka Goti	2,000	100	2,100
Burshoree	1,000	50	1,050
Kassim ka Joke	1,000	50	1,050
Bagh	1,000	50	1,050
Hajee ka Shahr	1,000	50	1,050
	7,000	350	7,350

A reserve of 400 camels was to remain at Jacobabad. A daily train of 500 camels at 4 maunds (320 lbs.) per animal would convey 60,000 maunds, or 2,143 tons, per mensem. The same daily train, each camel being loaded with 5 maunds (400 lbs.), would move 75,000 maunds, or about 2,678 tons per mensem. Thus the carts and camels might be calculated to move in a month as far as Jacobabad 95,000 maunds of supplies, but further forward to Dadur only 75,000 maunds, demanding a still further supply of either pack or wheel transport to carry 20,000 maunds to Dadur, and thus equalize the supplies thrown into Jacobabad, and passed on to the foot of the Bolan, to avoid an undue accumulation in rear. The 3,000 camels which were to be purchased in Rajpootanah, as well as the hired train which had been employed on the now abandoned route *via* Shahpore, were to be utilized for this purpose.

The Shahpore hired train consisted of 1,402 camels and 780 carts, but these latter got into bad condition as the owners, though well paid, had neglected the bullocks; however, it was hoped to utilize 600

carts out of the whole number for work, and these were to be divided into lots of 75 each, travelling on the following route:—

1. Nowra	12 miles.
2. Timkin	8 "
3. Kouranee	8 "
4. Bagh	10 "
5. Zivida	9 "
6. Hajee ka Shahr	9 "
7. Etree ka Shahr	5 "
8. Dadur	13 "

These carts would give a daily train of 36 carts (3 being kept as spare at each stage), able to move 10,800 maunds, or about 386 tons, per mensem.

Besides this calculation regarding the properly organized transport on the staging system, it was possible to expect contract transport, ponies, donkeys, and mules, with which to push forward further supplies; indeed, in one case, a contractor had already supplied 1,199 camels and 180 carts, and had removed 6,948 maunds of supplies to Dadur.

The success of the organization set going mainly depended on the possibility of obtaining all the transport required so as to allot the proper number of carts and animals to each stage. For the Afghan camels to be purchased drivers were also to be provided, and the services of the 30th Regiment Bombay Native Infantry were demanded for the purpose. Had this plan of employing native troops as drivers been adopted from the very first, the transport would have been more regular, the desertion of drivers would have been much reduced, the animals would have been better attended, and the guards for convoys would have admitted of considerable reduction.

For the conveyance of the supplies through the Bolan Pass to Quetta it was intended to use mules, ponies, and donkeys. The load for strong camels was fixed at 5 maunds (400 lbs.), and for weakly ones at 4 maunds (320 lbs.). At each stage where carts were posted, two carpenters and two blacksmiths were kept to execute repairs. The hours for marching were fixed between 5 o'clock P.M. and 10 o'clock A.M.

The Transport Staff was organized as follows:—

A Superintendent in charge of the base at Sukkur, and from that to Jacobabad.

A staff officer of the train at Sukkur.

A Quartermaster of the train at Sukkur.

One Assistant Superintendent at Shikarpore.

" " Jacobabad.

For convoy duty three subaltern officers.

From Jacobabad to Kassim-ka-Joke and Timkin—

One Superintendent.

One Assistant Superintendent at Jacobabad.

" " Nehal-ka-Goti.

" " Burshooree.

" " Kassim-ka-Joke and Timkin.

From Kourani to Dadur, under the orders of the Director of transport—

One Superintendent.

One Assistant Superintendent at Bagh (Telegraph office).

" " Hajee-ka-Shahr.

The officers were to report by telegraph direct to the Brigadier-General in charge of the communications every case where the fixed number of carts or camels did not start.

By the end of April, 1879, 271,300 maunds, or 21,704,480 lbs., had been forwarded from Sukkur; 223,359 maunds, or 17,868,720 lbs., from Jacobabad; and 120,167 maunds, or 9,613,360 lbs., from Dadur. By the 25th May, 1879, all supplies had been cleared out of Dadur with the exception of 50,000 maunds kept there as a reserve. In the Bolan Pass a new road 21 miles long was made between the camp near Dadur and Kirta, and a new line laid between Kirta and Mach, by which were avoided dangers from floods, as also five or six miles of shingle between Abigoom and Mach. It was ruled that each two bullock carts journeying on the Bolan route was not to convey more than 640 lbs., and special attention was to be paid to the shoeing of the bullocks. The Pass was found to provide a plentiful supply of forage for bullocks, mules, and ponies, but none that the down-country camels would eat.

On the other lines of operations, on the 29th April, 1879, a reorganization of the transport was decreed; so thoroughly had the transport failed that the Government were not deterred from attempting a reorganization of it during the actual progress of the war, always a risky undertaking.

Afghan War, 1879-80.

Hensman, in his *Afghan War of 1879-80*, shows that, though only a few months elapsed between the conclusion of the Gandumuck treaty and the resumption of hostilities in September 1879, "the transport in the Kurram Valley Field Force had, upon Cavagnari's departure for Kabul, been allowed to dwindle down to very insignificant proportions."

When (consequent on the destruction of the Envoy and his party) military operations were resumed, there was little or no transport available. In the advance to Sufed Sang it was so insufficient, that the animals, after a heavy march of 15 miles and a short rest, had to be sent back to take up a second load, thus doing double work. After Sir F. Roberts' occupation of Kabul, the Kurram line, with the winter approaching, was given up, and the Khyber route became the only real line of communications. The direction of supplies and transport on this line was entrusted to Major-General Sir Michael Kennedy; the transport being divided into two distinct parts, one for work with the Kabul Field Force, the other in the Khyber line. The Staff for the first was constituted as follows:—

Chief Director of Transport (also in charge of the 1st Division).
Staff Officer to Chief Director.
Paymaster.
Inspecting Veterinary Surgeon.
Veterinary Surgeon.

1ST DIVISION.

Chief Director in charge.
General Transport Officer.
Assistant General Transport Officer.
1st Brigade Transport Officer.
2nd Brigade Transport Officer.
Cavalry and Artillery Transport Officer.

2ND DIVISION.

Director of Transport.
General Transport Officer.
Assistant General Transport Officer.
1st Brigade Transport Officer.
2nd Brigade Transport Officer.
3rd Brigade Transport Officer.
Cavalry and Artillery Transport Officer.

Transport Officers.

1 per 1,000 animals belonging to the General Transport of the Division and Brigades.

Transport Officers.

1 per 1,000 animals belonging to the General Transport of the Division and Brigades.

The supreme control of the transport arrangements rested with the General Officer Commanding, under whose orders the Chief Director of Transport, generally at head-quarters, had the direction of the entire transport of the force. Transport and equipment was obtained as needed by requisitions on the General Commanding the line of communications, the Chief Director, under the authority of the General Officer Commanding, being empowered also to purchase or contract locally.

On the Khyber line the transport for measures of supervision was divided into three sections. The first working between Peshawur and Basawal, the second between Barikab and Fort Battye, and the third between Safed Sung and Kabul. Each section had a transport officer to superintend it; these were located respectively at Lundi Kotal, Jellalabad, and Safed Lung. The whole distance was divided into fifteen stages as follows :—

1st Section—

Jumrood.
Ali Musjid.
Lundi Khana.
Dakka.
Basawal.
Lundi Kotal.

2nd Section—

Barikab.
Rozabad.
Fort Battye.

3rd Section—

Gundamuk.
Pezwan.
Jagdalak.
Seh Baba.
I.ataband.
Butkak.

The staff for the transport on the line of communications consisted of :—

Chief Director of Transport.
Staff Officer to Chief Director.
General Transport Officer.
Two Assistant General Transport Officers.
Paymaster.
Assistant Paymaster.
Inspecting Veterinary Surgeon.
Veterinary Surgeon.

Of this staff the Chief Director with his staff officer resided at the head-quarters of the General Commanding the Line of Communications. The General Transport Officer, one Assistant Transport Officer, the Paymaster, and Veterinary Surgeon resided at the base (Peshawur), while at the other end, or advanced depôt at Kabul, were located one Assistant General Transport Officer, and the Assistant Paymaster. Of these latter, the first was the connecting link between the Kabul Field Force transport and that of the line of communications, all convoys from the latter being consigned to him. This officer was charged with the establishment of sick depôts for animals either coming up with convoys or intended for transfer to the Kabul Field Force, with the formation of workshops for the repair of equipment and with the maintenance of a reserve of the same. He was especially directed to see that no incomplete or unrepaid gear was handed over to the Kabul Field Force. General Transport Officers in charge of sections were to move constantly about the stations among which their sections were working, supervising, inspecting, and superintending payments, etc.

Two remarkable marches deserve to be noticed in conjunction with the second Afghan War, both accomplished over the same ground, though by forces moving in opposite directions, and both performed under circumstances of peculiar difficulty. The march of Sir D. Stewart's

Division from Kandahar to Kabul, and that of Sir F. Roberts' Field Force from Kabul to Kandahar, to relieve the British garrison beleagured by Ayub Khan. The latter, one of the most brilliant feats of the whole campaign, which with the battle of Kandahar formed a befitting close to the War,* has eclipsed the first, mainly on account of our attention having been drawn at the time in that direction by reason of the interest attached to the relief of Kandahar. The march of Sir D. Stewart's Division, though not marked by the bestowal of a special bronze star, was in every point as fine a feat as the latter; it was carried out within sight of the enemy, which the other was not, but being performed under less stirring circumstances, has not yet received all the credit it deserves.

†Sir D. Stewart's Force, consisted of—

- 3 British Infantry Regiments.
- 5 Native " "
- 3 Native Cavalry Regiments.
- 1 Battery Royal Horse Artillery.
- 1 Field Battery.
- 1 Heavy Battery.
- 1 Mountain Battery.
- 2 Companies Sappers and Miners,

amounting in all to about 7,000 fighting men.

The marching state of the Ghazni Field Force on the morning of the 8th April, shows:—

Europeans	2,145
Natives	5,048
<hr/>	
Total combatants ..	7,193
Followers	6,207
<hr/>	
Total	13,400
Riding and draught animals ..	2,589
Transport animals.. ..	6,112

The Division left Kandahar on the 29th, 30th, and 31st March, 1880. The mortality in camels had been so severe, and the markets were at that time so badly supplied, that extreme difficulty was experienced in getting sufficient transport for this Division; however, by great efforts, and by a rigorous limitation of the *impedimenta*, a sufficient quantity of animals were collected in eight days. How carefully all the arrangements were made during this march can be gathered from the fact that, notwithstanding the difficulties of forage and the weak state of many camels at starting, during the whole march from Kandahar to Kabul, not more than 3 per cent. of the whole number died, not a single camp follower was lost, nor was a single camel carried away by the enemy.

During the first part of the march, as far as Shahjui, no difficulty in obtaining supplies was experienced; from this to Ghazni, the Division traversed a purely hostile country, with a daily increasing body of the enemy marching at some distance on its right flank. The inhabitants had quitted their homes and buried their grain and provisions; the latter measure was however of no avail, as these were dragged out by the Pathans and frontier men serving in our ranks. Young crops of

* The occupation of Kandahar did not end with the battle, but this made the British masters of the situation and nothing of any importance took place before the final evacuation of the city.

† An account of this march will be found in the April number of "Macmillan's Magazine" for 1881; from this and from a paper by Captain Elias, 59th Regiment, published in the Royal United Service Institution Journal, the following sketch has been compiled.

clover and lucerne were at this time well above ground, and proved useful for forage. From the 12th to the 21st April, the troops foraged for themselves, and, though often subsisting on a reduced ration, were never without food; nothing however beyond what was absolutely necessary for the troops was taken out of the villages.

On the 16th April at Karabagh (190 miles north of Kandahar), the General received trustworthy intelligence of the numbers and constitution of the enemy gathering on his right. Here the division halted for a day to recruit supplies which were to be obtained in abundance, though the so-called allies, the Hazaras, caused great trouble, and looted supplies which would have come to our troops. Large bodies of the enemy's troops, horse and foot, had up to this moved parallel with the line of advance; but on the 18th April the enemy came in contact with the British force, a reconnoitring party was fired at, and reported the enemy in force about three miles ahead; on the following day the battle of Ahmed Khel was fought. It is worth recording that the full fruits of this victory could not be reaped, owing to the enormous baggage train in rear, for the protection of which a large portion of the cavalry had been detailed. The baggage train, reduced as it was, is said to have extended in single file over 9 miles of road. On the 21st April, the division encamped outside Ghazni, where it halted for four days, having a second fight with a body of 6,000 Afghans at Orzoo on the 23rd April. This fight removed all difficulty regarding supplies which only the vicinity of the Ghazis had restrained the inhabitants from bringing forward. The division quitted Ghazni on the 25th April, marching slowly, on account of the wounded; on the 29th it effected a junction with Brigadier-General Ross' force, after which, by easy marches, the Logar valley was reached, when a long halt was made.

The division was fortunate in having splendid weather during its entire march. It traversed the distance from Kandahar to Ghazni (234 miles) in 21 days with two halts, one at Kelat-i-Ghilzai, the other at Karabagh, its marches thus averaged over 11 miles a day. A more than creditable march, it will be admitted, when we consider that the long and forced inaction at Kandahar had incapacitated a large number of men and animals for continuous exertion, that the baggage animals were almost exclusively camels, that an elephant heavy battery and ordnance field park (which precluded rapid marching), accompanied the column, and that with an enemy hovering on one flank, the reconnoitring duties were heavy, and interfered with the rapidity of the advance.

The march of Sir F. Roberts' troops from Kabul to Kandahar,* was undertaken in the month of August 1880, the force consisting of—

British officers	.. .. .	267
„ non-commissioned officers and men	..	2,556
Native officers, non-commissioned officers		
and men	.. .. .	7,325
Total fighting men		10,148
Public and privaters followers, and medical		
establishments	.. .. .	8,143
Total		18,291
Animals, cavalry horses included	.. .. .	11,224

* These details are taken from Colonel Chapman's lecture at the Royal United Service Institution, and from the report of the Chief Director of Transport, Kabul Field Force, to the Controller-General of Supply and Transport.

The transport animals with the Kabul-Kandahar Field Force are shown by this Return of Lieutenant-Colonel Chapman, Chief of the Staff, to Lieutenant-General Sir F. Roberts.

	Yaboos or Afghan ponies.	Mules.	Indian ponies.	Donkeys.	Camels
Number of animals that left Kabul on the 8th August .. }	1,589	4,510	1,244	912	6
Purchased <i>en route</i> }	35	1	—	208	171
Number of such animals that arrived at Kandahar 31st August }	1,179	4,293	1,138	1,078	177
Casualties	445	218	106	42	—
Lieutenant-Colonel Low's* return of transport animals is as follows:—					
Number of animals that left Kabul	1,616	4,509	1,303	955	—
Additions <i>en route</i>	35	1	—	908	101

The same difficulty with regard to transport as was experienced by Lieut.-General Stewart's force was not felt at Kabul, as the transport there was in a state of efficiency, and had been worked regimentally with success. The attention of both officers and men, European and natives, had been enlisted in caring for the regimental transport. The forced march ended at Robat, a point 18 miles short of Kandahar, and 295 miles from Kabul; it occupied 19 marching days, giving, therefore, an average daily march of $14\frac{3}{4}$ miles.

The only enemy was a hostile population which hovered on all sides ready to attack stragglers. The daily supplies of food and forage were drawn from the country after arrival in camp, but a considerable difficulty was experienced in obtaining sufficient firewood.

Many of the transport animals had daily to be sent long distances to bring in food after the day's march was over. To obviate the increased fatigue the animals had to undergo in having to proceed from one to three miles at the conclusion of the march to procure their forage, the standing crops of Indian corn were used, the animals being turned into them as they arrived in camp, the fields having been previously portioned off to brigades and regiments. Where no green crops were found, forage had to be taken out of the villages, the villagers, as a rule, doing their best to conceal it.

The passage of the Zambrook Kotal and of the Sheri Dahu Pass, taxed the powers of the transport. The actual length of the column of march by the shortest computation amounted to from 6 to 7 miles; the rear-guard leaving camp at 7 A.M., only reached the next encampment at sundown. Lieut.-Col. Chapman remarks: "The large number of officers detailed for baggage duty reduced the confusion to a minimum, and secured a pace in marching that could not have been anticipated, the baggage animals reaching camp for the most part very soon after the arrival of the troops."

As casualties and the sick list increased after leaving Ghazni, attempts were made to induce the people of gipsy encampments met on the road to hire out their camels as far as Kandahar; on their declining to comply pressing had to be resorted to. At Chardeh a gipsy camp

* Lieutenant-Colonel Low alludes in his report to the difficulty of obtaining correct returns, and this is proved by the difference in the number of transport animals employed as given by him and by Lieutenant-Colonel Chapman.

was surprised by night, and a number of camels, though without saddles, were driven into the British camp, the same operation was repeated further on with another of these camps. All pressed animals at the end of the march were eventually returned to the owners with the amount of their hire. The country was well suited for camels, being covered with a plentiful supply of the thorn they feed upon.

The transport of the column was largely composed of mules who, though the finest transport in a dry climate, require plenty of water to drink; at places, principally in the marches from Ghazni to Mukkur, water was very scarce, and this distressed the transport animals greatly. A loss of 40 mules being reported at Punjak, 130 donkeys were pressed, all that were not needed to replace missing mules being placed in charge of the Transport Officers with the rear-guard for the carriage of the followers who fell out. Every baggage animal that could be so utilized was employed in aiding the weary and footsore and bringing them into camp.

As animals gradually became spare from the consumption of rum, expenditure of treasure, and other sources, various demands for carriage could be met, though this was somewhat limited by the escape of 40 pressed camels, and a loss of 24 mules. The drivers whose powers were overtaxed by constant early rising and marching under a scorching sun, went to sleep whilst the animals were grazing, and many animals thus strayed away, or were seized by the lurking Pathans. The yaboos and ponies lost condition very much, and with this got sore backs; this more or less was the case with all animals, the number of sick ones, however, was so large that it was impossible not to use some in this state. The day of the battle of Kandahar, and the previous one, the animals suffered severely from want of water.

It is instructive to see how the losses increased during the march. Lieut.-Col. Low gives a summary of these between Kabul and Kandahar.

Between Kabul and Ghazni ($97\frac{1}{2}$ miles, daily average of march 14 miles), the losses in transport animals were—

Yaboos.	Mules.	Ponies.	Donkeys.
24 ..	10 ..	26 ..	26

Between Ghazni and Kelat-i-Ghilzai ($134\frac{1}{2}$ miles, daily average of march 17 miles).

Yaboos.	Mules.	Ponies.	Donkeys.
74 ..	58 ..	93 ..	43

Between Kelat-i-Ghilzai and Robat (63 miles, daily average of march $15\frac{3}{4}$ miles).

Yaboos.	Mules.	Ponies.	Donkeys.
161 ..	91 ..	126 ..	38

Between departure from Robat and 6th September (20 miles).

Yaboos.	Mules.	Ponies.	Donkeys.
110 ..	54 ..	20 ..	0

Shot on 3rd September as incurable.

Yaboos.	Mules.	Ponies.	Donkeys.
47 ..	3 ..	43 ..	0

Thus between Kelat-i-Ghilzai and Kandahar the greatest loss occurred, naturally the fatigues of the continuous long daily marches were telling now very heavily on the baggage animals.*

* Lieutenant C. G. Robertson, in his *Three Campaigns in Afghanistan*, relates how, through the attention paid by Colonel Boswell (commanding the 2nd Sikhs) to the men not overloading or neglecting their mules, the regiment marched into Kelat-i-Ghilzai without one sick animal, and, out of nearly 300, returned only three animals to hospital on reaching Kandahar.

Zulu War, 1879.

The difficulty of obtaining transport, on the chance of military operations having to be carried out against the Zulus, was recognized as early as in the month of September, 1878, and was pointed out by the Lieutenant General Commanding, who, in reiterating his request for trained Transport Officers, alluded to the extravagant prices demanded between Durban and Pietermaritzburg even at that early date. A return prepared about this time showed that the cost of hiring 100 wagons for eight months, at a low rate of 2*l*. per diem, would exceed by 3,440*l*. the cost of purchase of the same number of wagons and teams, together with the keep of their conductors and leaders, and 25 per cent. for repairs, depreciation of plant, &c. Invitations for tenders for transport having met with no response, furnishing carriage by law was recommended, but at that period requisitions for transport were considered premature. On the 5th, 6th, and 7th September, a board assembled to consider the best means for providing transport; of the three methods proposed, viz.,—pressing, hiring and purchasing, the Board strongly recommended that the last should be adopted.

An official return showing the distribution of the troops in the field in Natal and Transvaal on the 16th January, 1879, gives an idea of the Government and hired transport employed at the commencement of the Zulu War; by this it is seen that 1,058 conductors, drivers, and fore-loopers, with 14,283 oxen, 801 horses, 401 mules, 932 wagons and 65 carts, accompanied the five columns which first invaded Zululand (of the five columns, the 3rd lost on the field of Isandlwana 136 wagons, and 1,400 oxen). During this first phase of the Zulu War, the transport was mainly obtained by a system of hire of oxen and wagons.

The plan of making or purchasing wagons to be fitted at Durban with teams of oxen, gear, &c., did not answer, the owners objecting to part with their oxen without selling their wagons. This plan presented difficulties in the way of getting drivers and leaders, for the men turned out of kraals for this service were inexperienced men and ignorant in the management of oxen: wagons and spans complete had soon to be purchased from planters and farmers. Some owners came in from King Williamstown and Grahamstown and other parts of the old Colony to hire out their carts. In certain places it was found easier to hire than to buy, as the owners could let the Government have their plant for a certain space of time, but could not dispose of it altogether. Hiring wagons had the advantage that these could be discharged at short notice, while those the property of the Government had to be sent long distances to be sold by auction, and, as the cost of the outlay at the commencement of the war was very high, a considerable loss in their disposal was thus incurred. In some cases colonists were entertained as conductors, being placed in charge of 8 or 12 wagons, and some of these men remained with the transport till the end of the war; but many likely men had joined the Mounted Volunteer Corps, hence some men with only a few weeks' experience of South Africa had to be engaged as conductors and sent to the frontier. The best transport during the war was that hired by the month or by day, in charge of conductors selected by the owners of wagons (one conductor to 10 wagons). These conductors often owned themselves one or more wagons, the rest in their charge being owned by relations or friends from the neighbourhood of their homes. For transport from the base to the frontier that hired by the ton or cwt. was the most reliable. As professional transport drivers flocked to places where they were certain of full loads and fair prices, there was no difficulty in finding in the open market what was needed, though the rates varied with the

demands. When transport was hired by the day it was found that owners were apt to lose time on the road.

When, after the disaster at Isandlwana, large reinforcements from home were added to the troops already in the field, there arose a great pressure for transport, and a rapid rise of transport rates was inevitable, a consequence, which only liberal rates of hire by the month for ox wagons or purchases could relieve; the ox transport was also reinforced by a large importation of mules from the Cape Colony, and North and South America. At the beginning of July, when the greatest quantity of transport was in use, it was estimated that, besides carriage by private contractors moving stores and supplies to the frontier, about 400 horses, 3,000 mules, and 24,000 oxen were employed for army service.

The state of the roads has always a great effect on the transport, as their good or bad state influences the description of carriage, the length of the stages, and the weight to be carried. In South Africa there are no actual roads, but only tracks which traders' wagons have left; these lead over mountain passes, through dongas, drifts, and across the veldt. The ever varying condition of the weather affects the tracks; in dry weather hard and strong presenting no difficulty to the passage of heavily laden wagons, but during wet weather the ground becomes soft and muddy, nothing more nor less than a quagmire. In the dry weather the dust lays 6 or 8 inches deep, and this on wet days is worked into greasy mud presenting serious impediments to heavy traffic, whilst the drifts in their turn become swollen and add to the difficulties of the transport. Another drawback to the employment of a large ox transport in this war consisted in the insufficient crop of grass, the result of the drought during the summer season, fires, and the caterpillar pest.

The length of the line of communications from the base to the 2nd. Division and Flying column, at first 200 and latterly 300 miles, and the having to supply 7,000 men, chiefly from Natal, over this lengthy line, added considerably both to the difficulties and expense of the transport. The absence of all proper roads, conjointly with the adopted system of transport of the country by heavy wagons (the only available one in any large quantity), necessitated the employment of large teams of animals. These large teams spun out the trains to an undue length, and were a source of weakness and anxiety throughout the operations. The estimated cost of transport and travelling during the war, from 1st August, 1878, to 30th September, 1879, was 1,684,398*l*. Some idea of the cost of transport can be formed by looking at the rates paid per ton for the carriage of stores and supplies; these were 22*l*. per ton from the base to Fort Pearson, about 70 miles, and 75*l*. per ton from the base to Koppie Alleine, about 200 miles.*

The principal animals employed for draught were oxen, mules, and horses. Most Transport Officers accorded the preference to ox transport, regarding it as the mainstay of the transport to be employed in South Africa. There oxen are easily procurable, feed on the pasture of the country, require a smaller number of followers to tend them than other animals, and are well suited to draw heavy loads at a uniform pace on bad roads. The weight of body and the persevering nature of the animal makes it suitable for draught in muddy roads and heavy spruits. The mortality in oxen during the war was very great, as the animals had to be worked in the unfavourable season. As military operations have often to be carried out independently of the season it is a serious

* Gillmore says that one of the causes of the high rates for transports during the Zulu War was that the teamsters did not feel safe, and had no confidence in the soldiers.

drawback having no grass in the winter or dry season, during which oxen, if worked, are liable to a very high rate of sickness and mortality. The compensation for losses in oxen for the 1st Division alone, during a period hardly extending over six months, amounted to above 80,000*l*.*

Oxen in low condition cannot stand severe changes of weather, and a wet and cold winter's night will kill a number of them. The only oxen that can live on the coast districts are the Zulu oxen, bred, seasoned, and acclimatized. But as it takes several months to accustom these animals to feed on corn and chopped hay, on which food they will not thrive as well as on grass, their not readily taking to other forage reduces the value of this description of animal for army transport. The large number of these animals that has to be employed demands considerable grazing ground, and in operations extending over a long period of time on the same line, the grazing soon gets exhausted and tainted. These animals are very liable to lung and bush sickness and red-water, and contagion soon makes itself felt where large herds are kept together. Ox transport requires sufficient expert drivers, experienced Transport Officers acquainted with this description of transport, and trained mounted conductors.

Horses were little used for draught; mules much more so, and proved not liable to the same extent as oxen and horses to the fatal sickness of the country. About 3,000 mules were employed during the war; of these 60 were French and Spanish, 420 (of which 399 landed at Durban) were purchased in Kentucky and Missouri, picked animals 15½ hands high, with an average weight of 10 cwt. From Monte Video, South America, 410 more, 13½ hands high, were purchased; these were harder than the North American. The nature of their native climate, work, feeding, &c., being similar to that of Natal, rendered them well suited to the country in which they were called to work. Further 2,140 colonial mules were purchased, at an average price of 23*l*. each, in Cape Colony, Orange Free State, Transvaal, and Natal. Of the four kinds employed, South African or Colouial, South American, North American, and French, the Colonial and South American answered best. The mortality amongst mules during the campaign amounted to about 8 per cent. A corps of carriers, about 1,600 in number, was employed after the battle of Uhundi; but the African carrier is not as patient and enduring as either the Indian cahar or the Chinese porter.

Wagons and carts used in the transport were of many kinds, but were mainly of four principal descriptions: The English built general service wagon, the South African, the North American large and small buck-wagon, and the Scotch cart. The first, though good for transport on good metalled roads, was found ill adapted for rough travelling; the South African and North American answered well; a small description of American buck-wagon, drawn by mules, was much approved of for use with flying columns moving either on good or bad roads, whilst for light loads Scotch carts were esteemed the best vehicle to accompany the troops in the field, being well adapted for rough work and rapid movements.

From the reports which have been rendered at the conclusion of this war, the following facts may be deducted. Ox transport in South Africa is the most readily obtained and most economically maintained, but should not be employed, if possible, at the season when the pasture fails and sickness makes its employment costly and dangerous. If military operations are to be carried out at such a time, mule transport should be largely used. Ox transport should be obtained by pressing at fair rates,

* The heavy loss of oxen in this Division was caused by the effects of the climate on the coast line, unceasing convoy duty, constant hard work, and absence of any reserves.

through the agency of the Civil Government, the owners of ox wagons being guaranteed against losses occasioned either by capture by the enemy, or overwork performed by order, but not through losses incurred by disease, poverty, or carelessness on the part of the drivers. The mules should be obtained from South Africa and South America.

The description of wagon needed is a strong, light, and cheap wagon calculated to do the work during the war, and to realize a certain value afterwards. For slow work not to weigh more than 17 cwt., and to carry a load of 3,000 lbs.; for rapid work a wagon weighing about 10 cwt., to carry a load of 15 cwt. For very rapid conveyance a third might be added, a light two-wheeled spring cart capable of holding about 8 cwt. Each wagon should carry some tools for repairing the road in bad places and should be supplied with the South African brake, which is easily repaired and does not cut up the road as the drag shoe does.

The harness should be lighter than the English, suited to the description of transport used, made for the occasion, and fitted at the base. Breast straps should be principally used and plenty of materials for repairs should be provided.

A pioneer force under an able engineer should precede every column to make any necessary repairs along the road, to corduroy the drifts with brushwood and grass, and to ease the slopes on both sides. The improvements of the drifts should admit of several wagons crossing abreast. The water rills should not be simply filled in with rubbish, for in wet weather they become mud holes, cause jolts, and entail breakages. The grass on ascents and descents should be burnt down, otherwise, when wet and trodden down, it becomes very slippery. Hills and fords can be easily surmounted by double spanning, but troops should be at hand with drag ropes to help wagons out of difficulties.

Major-General Sir E. Wood recommends for transport purposes in South Africa $\frac{3}{4}$ country ox wagons—18 oxen for "buck," 16 oxen for "tented" (this would allow for a pair of each becoming inefficient), the other fourth to be American wagons, drawn by 10 mules. Loads not decreasing daily to be fixed at 4,500 lbs. for ox wagons, at 2,200 lbs. for mule wagons. The length of march for ox wagons to be from 10 to 16 miles a day, according to the nature of the country traversed. For mule wagons drawn by part corn-fed mules, 20 to 25 miles, if not corn-fed, about 15 miles.

The points he considers insufficiently attended to in the colonies are the necessity of drag chains, span break blocks and preventer chains, which should be lashed from the fore tongue to the end of the dyssel boom, so that when a boom gives way going up hill the wagon may be held by the chain.

CHAPTER IV.

TRANSPORT BY CARRIERS, PACK ANIMALS, WHEEL CARRIAGES, &C.

There are various descriptions of land transport suitable for military purposes, and no other country has ever employed the same variety as we see used in our wars. Elephants, camels, horses, mules, ponies, donkeys, bullocks, horse and mule wagons, bullock waggon and carts, carriers, etc., have all been used by us in our military expeditions. Of these the most susceptible of order and the most suitable to the country in which operations are to be carried out should be chosen

in preference to all others to accompany the troops, the other kinds will always be useful for working on the line of communications in rear.

As a general rule the best way to secure a sufficiency of transport will be effected by utilizing what transport the country itself possesses, as the carts, the animals, the saddles, the harness, &c., will be found well suited for all general purposes. There is nothing that demands any peculiar description of conveyance for supplies and *matériel*—wagons, carts, pack animals carriers, are all alike useful and adapted for the purpose. The choice rests with the organizing officer, who is to form out of the means the country presents an economical and efficient transport, consonant with the military requirements, and to endow it with such a superintendence as will insure its efficient working. Water-carriage is also a useful means of transport which, whenever available, should not be neglected.

It should be borne in mind that our Commissariat Transport Corps is seldom called to take part in our small wars and expeditions, and with good reason too, for, besides that many of these wars take place in and from India, it is all one description of transport, wheel carriage, which cannot be employed in countries wanting in good roads; in other countries, like the Gold Coast, where horses cannot live and where not a blade of forage is to be found, it is equally useless; again, in the Transvaal and Natal, during a certain season of the year, horses sicken and die in large numbers. The Indian moveable column carriage, the Indian transport, cannot also with safety be removed from the various head-quarter stations, hence the general course pursued in our wars is to buy or hire a large number of animals, which at the conclusion of the operations are either discharged or sold at a great loss.

Our convoys are very large and demand a transport on a large scale. The description of transport most convenient for use in war depends always on the nature of the country in which the war is to be carried out, and should be modelled on what is found to answer best there in time of peace. If the country is intersected by good metalled roads, wagons and carriages will constitute the principal portion of the transport; where the roads are stony and bad, and the country is mountainous and mainly intersected by tracks, mules and pack animals of all sorts will be used; in desert and sandy countries camels will be found to answer best; in others where animals are scarce, or the nature of the country precludes their use, as, for example, on the West Coast of Africa or the hilly regions on the Eastern frontier of India, carriers will form the main portion of the transport corps. In procuring a large number of transport animals a good margin must always be allowed to provide for casualties.

It is important not to neglect using any of the means of transport which can be found, the best and most adapted to the country being used first. Every ounce of supplies taken to the front, no matter by what means, will be of assistance in furthering the success of an expedition, and the shorter the time occupied in the operations the greater will be the economy.

Carriers.—In several of our wars and expeditions, but principally in those in China, Abyssinia, Looshai, Ashantee, and Duffa, carriers have been largely, and in some entirely, used for military transport. Not only in India but in many other countries the entire carriage of the sick and wounded has been performed by carriers. Carriers, therefore, are a recognized means of transport, and, if judiciously used, can render important assistance to an army in certain countries where other means of carriage are wanting or insufficient.

Carriers may be said to be the principal means of transport known in many parts of Africa. The long strings of slaves often met with by

travellers in that part of the world are nothing more or less than huge caravans, where for animals are substituted men and women carrying heavy burdens.*

Carriers have different ways of carrying loads; some carry entirely on the head, a general custom in most parts of Africa; some carry on the back, as, for example, the hill coolies in India; some of these latter bring both the head and the back to bear and carry a heavy load in a *kilta*, or conical shaped basket, on the back, with a strap of leather passed round the forehead; with others a load is divided between two or more men who carry it pending from a pole or bamboo: in some parts of India and in China coolies also carry heavy loads suspended from the two ends of an elastic piece of bamboo. As a general rule, in hilly countries men will be found to carry their burdens on the back—and in flat countries on the head.

In the China and Ashantee wars, the established weight of a load for each carrier was fixed at 50 lbs., though in reality it seldom came up to that. Some use was made of women carriage in the last, and it was found that they carried as heavy a load as the men, with the addition generally of a child on the back, and did their work very cheerfully. Of the Zulus, we read that they entrust their commissariat to the women, who perform long journeys on foot, often exceeding 40 or 50 miles a-day, carrying supplies for their warriors. In the Looshai and Duffla expeditions the weight of a load, owing to the steep and slippery state of the roads, was limited to 40 lbs.†

With regard to distance, on good roads 12 miles with a load and 12 back without one is reckoned a good average distance; if not returning the same day the stage may be increased up to 15 or 16 miles. On bad or hilly roads, 8 miles going and 8 returning is considered sufficient. After a fixed number of days' work a day of complete rest should be allowed: if want of stores force a rest on a working day, the day fixed for rest should be devoted to work.

In estimating the amount of supplies transported in small loads by carriers a certain quantity must be deducted from the total weight of the same, as a great number of boxes, cases, kegs, etc., will be required for a certain quantity of supplies when sub-divided into small fractions. Stores require to be made up as much as possible into packages of uniform weight which will materially help in loading. Packages of certain shapes are better balanced and are more easily carried than others; on the Gold Coast the carriers preferred the conical tubs containing salt meat to the rectangular boxes of tea, flour, rice, and preserved provisions.

Transport by carriers is objected to as less economical than other means; this, however, depends a good deal on the price offered for hire (in Zululand it was said that the carriers set little value on the pay they received). If we consider the outlay incurred in procuring other descriptions of transport, take into account the days lost in return journeys, the dépôts required for broken down, worn out, sick and disabled animals, establishments for repairs of transport *matériel*, replacements, spare animals, compensation for losses, etc., all of which can be dispensed with when carriers are employed, we can assume that carriers, after all, are not as expensive a system of transport as some people pretend.

* Cameron says "The whole of the trade transport of tropical Africa is at present dependent on human beings as beasts of burden, and valuable labour, which might be profitably employed in cultivating the ground or collecting products for exportation, is thus lost."

†† Mons. Dutrieux, Belgian explorer in South Africa, calculates that the elephant will carry as much as 23 men, a mule or ox as much as 4 men, an ass as much as 2 men.

It has been said of the Zulu War that the cost per ton of carriage by carriers was four times as expensive as the most expensive transport employed during the month before the battle of Ulundi, and eight times as expensive as the average cost of transport by oxen or mules during the whole period of the war.

It is no doubt a very expensive description of carriage, but against it there is no outlay, while there are many indirect charges for other transport which we doubt if they have all been taken fully into account in calculating the total cost.

In countries liable to a sudden downpour of rain, biscuit runs the risk of being damaged if carried in bags. Where loads, besides, are continually taken up and put down, which is particularly the case with carriers who require periodical rest, the biscuit is much broken and reduced to dust, and the contents of each bag soon diminish. In the Ashantee War biscuit was carried in bags, the bags got torn and broken, and the carriers helped themselves freely. Some better way of packing biscuits than in bags might be adopted with advantage; when these are used they should be of strong material and well sewn.

Carriers (except in cases of danger, when they keep together and close to their escort) have the disadvantage of extending to great length on the line of march, and of requiring strong escorts. The mates and superintendents should be armed and should form part of the escort. Another disadvantage is that they have their own things to carry in addition to their loads and in some countries blankets, waterproof sheets, and spare clothing have been considered indispensable to keep them in health. It is useless to encumber with clothing men who in their natural state wear hardly any; this can only affect their freedom of movement whilst it adds to the weight to be carried. They will be more useful whenever they have nothing to carry beyond their loads, and can arrange for their own subsistence instead of being fed by the Commissariat; this will be generally possible where a staging system can be arranged, for the carriers would as a rule return the same day to their starting station and be again available to carry a load on the following day. In this respect they have the advantage over other carriage, that every other day is not lost by having to go back empty to get a fresh load. Only the hire for work performed has to be paid; staging close to their abodes, if the men get sick, they remain in their homes, there is no need for depôts, and the people being paid the war becomes a source of gain to them. Carriers can move over any ground and take short cuts; with them no reserve is needed, as a reserve would only afford a temptation for shirking work; if no money is paid except for a load brought in the loads will be forthcoming.

The carrier, however, unlike the transport animal, fully understands the risk he incurs; on the appearance of danger he can with the greatest ease get rid of his load and seek safety in flight. The loads thus abandoned would retard a retreat, and have a demoralizing effect on a retreating force; precious time would also be lost in endeavouring to save the property from falling into the enemy's hands. Hence, whenever there is the slightest chance of an engagement, the carriers should be kept well in the rear and not be allowed to follow too close the fighting body.

The operations of the allies in China in 1860 offer a very good example of transport done by carriers; both the British and French armies availed themselves of this description of carriage. The organization on the British side has already been alluded to in page 41, but it should be noted that the general efficiency of the Chinese Coolie Corps in this expedition was due to the corps being efficiently officered, well

organized, and to the coolies having become well familiarized with their work before the corps actually took the field.

As for the French, the following General Order will show the organization adopted by our Allies in forming their corps of carriers:—

“ *Shanghai, 1st May, 1860.*

“ *General Order by the General Commander-in-chief de Montauban.*

“In view of the insufficient number of horses and mules to undertake the transport service of the expeditionary corps, the General Commander-in-chief has decided on organizing a coolie corps, which will be called the auxiliary transport of the army.

“This corps will be placed under the direction of the Sous-Intendant head of the administrative branch, and will be composed as follows:—

1 Naval Lieutenant as Commandant.

1 Sub-Lieutenant as Paymaster.

1 Quartermaster sergeant as Paymaster's assistant.

1,000 coolies forming 5 companies of 200 men each.

“Each company will be commanded by a Sub-Lieutenant, and its cadre will comprise:—

1 Quartermaster sergeant acting as Serjeant-major.

4 Corporals, of which one will act as Quartermaster serjeant.

“Each corporal will thus have 50 men under his orders.

“To facilitate the assembly of the coolies and the discipline of the corps, each company will have a distinctive colour, as follows:—

1st, Blue.

2nd, Red.

3rd, Yellow.

4th, Green.

5th, White.

“Each coolie will wear sewn to his vest or to his blouse a small piece of cloth which will be of the distinctive colour of the company, and will have a regimental number ranging from 1 to 200, so that the squads will be thus composed in each company—

1st squad, from number	1	to number	50
2nd squad	„	51	„ 100
3rd squad	„	101	„ 150
4th squad	„	151	„ 200

“The Corporals will carry a badge of the distinctive colour of the company.

“A Military Medical Officer will be told off by the Sous-Intendant for service with the coolies.

“The Commander will receive an extra allowance of 60 francs, and will be horsed from the remounts.

“The Sub-Lieutenant paymaster will receive an extra allowance of 75 francs per month, which will cover the office expenses.

“Each of the other Sub-Lieutenants will receive 30 francs additional per month.

“The non-commissioned officers will receive a supplementary payment of 50 centimes per day, and the corporals of 25 centimes.

“The payment of the coolies will be made every five days in the presence of the Commander of the company.”

Another Order of a previous date had been issued by Captain d'Aboville at Canton, and, as it bears on the enlistment and pay of the coolies, it will be given here also in full.

"Canton, 25th April, 1860.

"In consequence of orders received from superior authority, and on account of the requirements of the China Expeditionary Corps, the undersigned Post Captain, Chief Commander of the French forces in Canton, with a view to insure the transport service of the army, engages a number of Chinese coolies under the following conditions, viz. :—

"The Chinese coolies divided in squads of 100 men will have at their head two headmen of different classes, whose pay is fixed as follows:—

1st Class	{	10	piastres (or 55 francs) per month, before
Headmen			starting.
	{	11	" after the departure from Canton.
		12	" in time of war.
2nd Class	{	7	" before leaving Canton.
Headmen		8	" after leaving Canton.
	{	9	" in time of war.
		5	" before leaving Canton.
Coolie	{	6	" after leaving Canton.
		7	" in time of war.

"The payment of the coolies on service will be made in arrears, and every month. It must be understood, however, that this regularity of payment will be in conformity with circumstances, and that a delay will not entitle any complaint on the part of the men enlisted.

"Every headman or coolie will receive a daily ration composed of salt meat or fish and rice, as follows :—

Rice	906 grammes.
Salt meat	225 "

"The right towards pay and ration will commence from the day the coolies are inscribed on the rolls.

"Every six months each headman and coolie will receive a jacket and a hat free of charge.

"A blanket will be issued to each man on the day of his enlistment. This blanket remains the property of the State and the issue will not be renewed.

"The headmen and coolies must engage for service in the North, to accompany the China Expeditionary Corps during the entire campaign, and will not be in any case allowed to claim their discharge during the course of the expedition.

"The engagement of the coolies shall not exceed two years, counting from the day of their inscription on the rolls. In every case the authorities may discharge them before the expiration of these two years, should the exigencies of the service demand it.

"Every Chinaman who, contrary to the above clause, shall quit the service to which he is bound will forfeit all claim to the pay due to him, whatever the amount may be, and will forfeit at the same time the right to a return passage to his home.

"All headmen or coolies, whatever may be the amount of pay to which by the above clauses they may be entitled, may remit to the person named to the proper authorities an invariable sum of three piastres per month. This remittance will be paid by the Canton Administration every month or every three months in arrears.

"The Chinaman will receive an order in favour of the party to whom he consents to make the remittance, and every payment will be made at the time in the presence of the receiver.

"The present order will be read in the Chinese language to every Chinaman engaging by the interpreter attached to the Treasury.

"The Chinaman engaging will sign opposite his name on the roll, and, if unable to write, his signature will be replaced by that of two witnesses.

"No advance of pay will be issued before the departure."

The great advantages transport by carriers has over other transport are the absence of any outlay, ability to move over any ground, and no loss in return journeys; the men, as a rule (in staging operations which are so well suited for this description of transport) returning to their villages every night ready for a load the next day. It is, however, expensive: the pay given to each carrier in the Ashantee and Zulu Wars was fixed at 1s. per diem (the unit of our silver coinage), to which rations, or a money allowance in lieu thereof, was added; being a voluntary service, the pay required to be made attractive, and to be in keeping with the price of labour. The Zulu carriers, though not knowing the value of money, were paid better than the fighting men of native levies, and received 10s. a month more than the men of the native contingents. Transport is a very considerable item of expenditure in all wars, and ours are, as a rule, carried out in wild unproductive districts with bad roads, at times only a track, hence a larger quantity of transport is needed, and this item in the general expenditure is greater: this being so, we must adopt the most economical description of transports which can be utilized. With carriers alone we can arrive at a very near estimate of the cost of transport, for there is no first outlay, no procuring of animals and *matériel* from distant places, no sick animals to look after and feed, no broken saddlery, harness, and *matériel* to repair; the men are paid for each load carried and nothing else. Let us consider the cost of carriage for a ton of supplies over 100 miles: admitting one-fifth in addition for packing boxes, etc., there will be to be carried 2,688 lbs. in all, divided in about 54 loads: 100 miles can be divided into 8 easy stages of 12½ miles; 54 carriers for 8 stages gives a total of 432 carriers for the whole distance. Suppose each man receives 1s. per load, the whole would amount to 217. 12s., to which should be added the pay of superintendents, and, assuming two for each gang of 54 carriers sufficient, at say, 2s. a head, 16 superintendents would be required, costing 17. 12s.; thus 237. 4s. would be the cost of 1 ton of provisions carried over the named distance. If rations or ration money is also given, it would cost one-fourth more, and 57. 7s. 10d. added to the pay would make in all 287. 11s. 10d. The additional cost in making up small loads, which this description of carriage needs, is an indirect charge which should also be taken into account. Thus, when compared to carriage by pack or wheel transport, both in quantity and expense, transport by carriers is not the most economical. We must not attach, therefore, any undue importance to it, it is a useful auxiliary transport not to be neglected, but only to be employed in preference to other means in exceptional cases.

In the Zulu War 270 tons were carried by the carrier corps; and as the cost of the corps was 10,000l., each ton transported cost 37l.

During the Indian Mutiny, where reinforcements were urgently required, carriers or coolies were used to draw carriages on the Grand Trunk road. The common *dak gharries*, accommodating four men each, were used, each being drawn or pushed by 10 or 12 men, relieved along the road at regular intervals.

An organization by caste or tribe will be found preferable to one based simply on numbers. The headmen or chiefs of each tribe should in this case be employed as superintendents. The European officer attached to each division should remain with the same division throughout the operations, the carriers will acquire confidence in him,

and this arrangement is more akin to the customs of the people which are greatly opposed to continual changes.

The issue of tokens to regulate the payments will be found to answer well, a token being given for each load taken up and surrendered by the carrier on being paid up. It is on the system of issuing wads to beaters in India, to guard against the numbers swelling up at the end of a day's shooting when the pay is distributed.

Complete freedom in movement should be allowed and no regular formation insisted on, the carriers being permitted to halt at their pleasure. The greater latitude allowed, when possible, the quicker the distance will be got over.

Pack animals are generally used in hilly countries where bad and difficult roads abound. In determining the weight to be carried by pack animals on service, the minimum weight should be taken into account as a standard in preference to the maximum. The weight carried by pack animals is a dead weight, the animals are more difficult to load, are loaded a long time before moving off, and, on long marches with long periods of waiting, they bear their loads for a very long time, which is very trying and fatiguing; they are also much liable to sore backs and strains. Amongst a large number of animals suddenly brought together there will be many inferior ones, unfitted for pack by their shape, or whom poor food and continuous hard work will soon incapacitate. Pack transport should never be resorted to when there is any other kind of transport available, for it is the most expensive description of transport, because packing is very laborious, and with the best packing a large number of animals will be always incapacitated for work.

For horses and mules the weight to be carried is generally laid down at 200 lbs., pack-saddle included. In the course of an expedition, particularly if the forage is scarce or of inferior quality, the animals become progressively weaker, and their loads must be lightened. In the Abyssinian Expedition, for example, the load carried by mules had to be reduced to 100 lbs., not including the pack-saddle. It may be assumed, as a rule, that from 150 to 160 lbs., in addition to the saddle, is a fair average load for pack animals doing continuous work on bad roads, in a poor country.

It is unreasonable to expect military transport animals to keep in the same condition as those of traders, whose animals move in small bodies, at the most convenient time, have not to submit to frequent irregularity of gait to conform to the movements of the troops, and are not hampered by crowded roads and other unfavourable circumstances. If experienced packers are attached to each convoy to superintend the saddling, in a special way before starting, and to examine all backs after a march, many animals will be saved. Careless drivers, though knowing that their animals are galled, would load them the next day, which an expert packer would never permit to be done.

Pack transport was extensively used by the British Army in the Peninsula, but of all transport it is acknowledged to be the most troublesome and difficult to arrange; it has the great drawback of lengthening considerably the columns on the line of march, it requires more animals and attendants than wheeled transport, and the food consumed by both, in those cases where everything has to be carried from the base, reduces a good deal of the useful weight carried. Pack transport, however, unlike carriages of all sorts, can follow the troops over most descriptions of ground, and many occasions have occurred in which we have been obliged to rely entirely on this kind of transport. In this description of transport there is not the noise which is the usual accompaniment of a wagon train, such as the

cracking of whips and rumbling and creaking of wheels. The amount of dust raised by a pack train, also, is so small as to be almost imperceptible at a moderate distance.

Pack transport is particularly applicable to the conveyance of infantry reserve ammunition and entrenching tools, on account of the great advantage it has over carriages of being able to follow the troops over any kind of ground. In a retreat it can move off the high roads, and does not obstruct the movements of the troops, especially of the artillery.

As pack transport must, as a rule, form an important part of the transport of all armies, it cannot but prove instructive to hear what the latest experience has shown with regard to certain disputed questions on transport, for experience is, after all, the great teacher of the art of war. Lieutenant-General Valentine Baker (Baker Pasha), in his *War in Bulgaria*, enters into the question of pack transport, and his judgment, being based on experience and recent observation in the field, should be received with all consideration. The want of proper roads in Turkey, it should be remembered, affected the question greatly. With regard to pack animals, the General says, "pack animals on a campaign have immense advantages. They can follow you over any country, and, if the horses are good and the loads are light, they will travel almost as fast as the ordinary riding pace of a journey; but much depends upon the care with which they have been selected, and the attention which has been paid to the pack-saddles, the boxes* which are slung on them, and the numerous little details of equipment. The Turkish pack animal is expected to carry a load of about 240 lbs., but with this weight it is impossible to expect quick travelling."

Again, he says, "pack horses in a campaign have a further advantage over all transport on wheels. While carts constantly get blocked on the roads by advancing or retiring military trains, the pack animal, if thus prevented from getting into line, can be led out into the fields, and still make his way to the front."

The following passages referring to the question of proper carriage for entrenching tools and spare ammunition on pack animals are likewise worthy of serious consideration:—

"In the recent organization of the British Army, it has been determined that spades and pickaxes sufficient for entrenching purposes, and carried in transport wagons, shall be attached to each regiment.

"Acting on the broad undulating plains of Germany or France, this system would probably be effective; but though myself an advocate of the plan which has been adopted, the lessons of the late war have led me to believe that these implements carried on pack horses are much more likely to be ever present with the battalion.

"It is impossible in acting on a broken country, and when troops are marching by different roads, to keep any number of transport wagons present with their battalions in column of route, and if not present with those battalions, they would probably reach the positions occupied too late for throwing up the necessary entrenchments. The conclusion which I have formed, is that the Turkish system of attaching one pack horse for the special purpose of carrying the implements attached to each company, is that which is most likely to be useful in modern war; and, moreover, as has been before mentioned, this same pack horse becomes useful for administrative purposes when not actually employed in conveying the entrenching tools belonging to the company.

* From the nomadic habits of Turkish officers and officials, they have succeeded in inventing leather cases, something between a box and a portmanteau, very well suited for pack travelling.—*War in Bulgaria*.

* * * *

"Thirty pack animals carrying the reserve ammunition of the battalion are attached to it, and here we come to one of the most important, if not the most important, question in military organization, the supply of ammunition to troops in action.

"All countries are but too apt blindly to worship military success, and blindly to imitate the nations who have achieved it.

"Thus, after the Franco-Prussian War, there was a mania for imitating all that attached to the German Army, without carefully inquiring into the value of the details which were so readily copied. Amongst other points, the German ammunition supply was very generally adopted as equal to all ordinary military requirements. Yet the careful study of the history of that campaign, as written by the staff officers of the German Army, will show that in almost every serious encounter a portion, at least, of the Prussian forces engaged fell short of ammunition whilst in actual contact with the enemy.

"I am inclined to think that three pack horses attached to each company, coupled with a system of brigade and divisional ammunition columns, the ammunition in these columns being carried by wagons, will prove sufficient. In this case, however, the ammunition should be so packed as to be readily adapted to pack animal transport.

"It will be seen that by the battalion system for the transport and supply of war implements and ammunition that has been advocated, 48 pack horses would be requisite for each battalion. It will be found by experience that this number of transport animals, without any addition, except under extraordinary circumstances, will prove sufficient also to supply the battalion with the provisions necessary for the men from their nearest supply depôt.

"The facility which this number of transport animals always attached to the battalion affords for conveying sick and wounded men immediately to the field hospitals in the rear has already been touched upon."

Pack animals should not be loaded longer than it is positively necessary, as standing for long periods under a load before commencing a march will exhaust their strength. With plenty of hands and a little management this is not difficult to do. For the morrow's march the loads should be prepared and arranged the night before, the animals being loaded and started early, doing the best part of the march in the cool of the morning, and having plenty of time for feeding and resting the same day. The animals should be allowed to move at their own pace, pressing being carefully avoided. Spare animals should follow in rear to take up the loads of those unable to proceed. The convoy should never halt to attend on animals falling out, these animals should be relieved of their loads, and every means should be taken to bring them into camp.

The animals used for pack transport are horses, ponies, mules, donkeys, camels, bullocks, and elephants.

The horse amongst us is too well known to demand a special notice, though in a country like ours, abounding in good roads, it would be a waste of power to use him as an animal of burden. Horses are, however, used for this purpose in other countries, strong compact animals between 14.2 and 15 hand high being so employed. As a rule, horses are too valuable for riding and for draught to be much used as pack animals, and only those of a quiet temperament will ever carry a load well.

With regard to horses, and, in a certain way, also to other animals it is desirable to obtain only those animals which have been accus-

tomed to continuous work, as these can easily habituate themselves to the hardships of a campaign. Fatigue is apt to tell on those obtained direct from pasture, who for the first month or six weeks will not be up to the full amount of work expected of them, and who with difficulty habituate themselves to the hardships which are the lot of man and beast in war.*

Mules† are of two kinds, the cross between the ass and the mare, by far the most valuable, and that between the horse and the ass. The voice of the animals betrays their sire, for those of the first kind bray like the ass, whilst those of the second neigh like the horse. Mules can be worked from four to twenty-five years of age, and even longer, their common height ranges from 13 to 15½ hands. Big mules are inconvenient to load, and need more food to keep in condition; they are also, generally speaking, weak in their limbs. The most usual and convenient height is from 14 to 14½ or 15 hands. Mules should be bred from sound, serviceable, average sized, compact mares, and the nearer the mule approaches the horse, the more valuable he will be. The mule is naturally weak in the lower part of the leg, from the knee down, and as the animal has a horse's body, it is desirable in the breeding to obtain limbs and feet as large as possible; as these can only be inherited from the mare, the choice of a mare with a large foot is a desirable thing to look for in breeding.

The mule is more capable of bearing fatigue than the horse, is less restive under the pressure of heavy weights on his back, and his skin being harder and less sensitive renders him capable of resisting better the sun and rain. He lives as long, costs less, is more suitable as a beast of burden, and far superior in sure-footedness. He can do more daily work than the ox, but costs nearly twice as much, and is more expensive to keep, for the ox can be turned out to graze, but some suitable forage must generally be provided for the mule. He carries less than the camel, which like the ox, is cheaper to keep but very delicate, and, except those of the Bactrian breed, unfit for work in rocky, hilly, and wet ground. For general purposes the mule is the best of military transport animals. The mule has some excellent qualities; he is frugal, slightly affected by heat or rain, is easily fed and equally good for burden as for draught, he walks well, picks his way easily on bad roads, moves by the side of a precipice

* Horses, donkeys, mules and cattle in South Africa are destroyed by the tsetse fly (*Glossina Morsitans*), in appearance like our honey-bee but much smaller in size, against which there is no remedy known. As this insect occupies some localities known to the natives, the best plan advocated is to halt by day before reaching these places and to go through them by night when little danger will be incurred.† The fly is found in those parts of the country abounding in big game and as the big game is destroyed it is said to disappear. The horse disease, by some supposed to be *anthrax*, is a serious scourge also and carries off a number of horses. The animals should not be permitted to feed before the dew has dried on the grass, and should be encamped in dry places. During the Zulu war, woollen nose-bags were put on the cavalry horses when the dew was on the grass. The sickly season for horses is from November to April, and is principally confined to the low-lying districts; severe and wet weather hastens it on.

† The following treatise on mules will afford valuable information: Mr. Harvey Riley, "The Mule" (Washington, French and Richardson, 334 Pennsylvania Avenue). Also Lieutenant Dalton's translation of "The Mountain Artillery in Spain" (U.S.I. Journal of India, April and May, 1879).

‡ Dr. G. Geoffrey, Indian Medical Service, recommends a hypodermic injection at the seat of the sting, which is easy to find, of six minims of the following mixture quickly applied to neutralise the local poison before it takes a fatal hold of the animal.

R. Liquor Ammon: fort Liquor Morphia Hyd. Aquae, aa 2 ss.

with much safety, and passes over every description of ground, independent of roads. He is long-lived and seldom sick, though his infirmities are generally acute; his wounds and sores also take a long time to heal. Unfortunately he is easily alarmed by the noise of firing, by thunder, and by violent hail-storms.

In the Peninsular War and in Abyssinia mules were extensively used as pack animals, and in the Crimean War they were used in the land transport corps for draught. In India they form part of the permanent transport of the Punjab irregular force, and are used as pack animals in the mountain batteries. They have been also largely used for transport in the many expeditions which have taken place on the North-Western frontier.

The present inferior class of mules in the Punjab, is due to careless breeding—dams covered by bad stallions, starved and over worked while in foal—the mules themselves underfed and worked hard when young. The Indian Government has lately endeavoured to remedy some of these defects and has encouraged the breeding of mules by the importation of good donkey stallions.

Mules inherit the shape and peculiarities of the sire to a greater extent than those of the dam—from this latter they obtain size, but rarely inherit bad shape or unsoundness. In nineteen cases out of twenty the donkey stamps his shape and soundness upon the mule. Spavin, ringbone, side bone, or signs of laminitis or navicular disease are very rare, perhaps owing to the slow pace of their work, and their low and light action. Mares 14 to 14½ hands high, covered by the largest donkies, would throw good mules for draft; for pack, the best mares are between 13 and 14 hands. Not to interfere with horse breeding, only badly shaped mares disqualified by unsoundness for horse breeding should be used for breeding mules.

A trial was made with mules at Woolwich to test and compare their merits for service, but we are told with bad result. Many of the animals were of great size, and, whilst they were reported to have had a voracious appetite, they never came up to the expectations that had been formed as to their capabilities for work and endurance. In the United States Quartermaster-General's Report of 1865, occurs the following passage: "The experience of this (Secession) war has convinced all officers of this department that for the army trains mules are much superior to horses, and of late the horses have almost entirely disappeared from the trains, being transferred to the cavalry or artillery, and replaced by mules." From this it appears that mules have stood the actual test of several years' war in the United States with great success.

The principal mule countries in Europe are the south of France, Spain, Portugal, and Italy. The French mules are found on the borders of the Pyrenees, in Gascony, and Poitou; of all the best are those from the neighbourhood of the Pyrenees. Mules are used in Spain in the Catalan provinces, in the mountainous districts of Andalusia, and in the province of Alicante. Good draught mules come from La Mancha; in the districts on the slopes of the Pyrenees mules are much used for pack. During the Abyssinian Expedition mules were purchased at Cyprus, on the coast of Asia Minor, in Egypt, at Bagdad, and Bushire, and in the Punjab provinces of British India. Good mules are reared in North and South America: the principal provinces for mule breeding in the United States are Kentucky, Missouri, and Kansas. The Kentucky mules are of good build and showy, those from Missouri are hardy animals well able to endure privation and hardship. The Mexican mule bred by a jackass out of a mustang mare is also a very hardy, robust, and serviceable animal. All this is

worth noticing for we have to use the animal often in countries deficient of proper forage, where the mules bred in cold climates lose condition from the want of proper grass, though generally reputed more fit for severe work than those which have been reared in warm climates; the latter can keep their condition better on a coarse and inferior description of forage. The mules from the district between the Tigris and the Persian frontier have a great name, as also those of Poitou, in France.

The experience of our former wars has shown that the mules from Egypt, Syria, Persia, and India, thriving on little grain and coarse grass, are more hardy and enduring than the Spanish, which, being better bred, require better food to keep in good working condition.

In selecting mules for purchase, look for fine appearance, broad chest, strong neck, bright eye, fine legs, a moderate sized barrel, good length between the point of the shoulders and the withers, large hocks and knees. Reject narrow chested and big bellied, the latter are weak, and coarse feeders. Mules with a straight back are more suited for pack, those with a hollow back for draught; a consequence of the hollow back is a greater development of the hind quarters, whilst with a straight back is found a greater fullness of ribs.

A loaded mule will walk a little over three miles an hour. The same pace should be maintained throughout, for either trotting or slow moving with long halts exhausts and injures the animal. His gait is slow moving down hill, quick up hill.

Mules are gregarious and follow their leader without much difficulty after a few days marching, hence it has been found that driving mules answers better than leading, particularly on bad roads and mountain tracks; the animals, if loose, will follow the leading one and the sound of his bell, more freely than when tied head to tail together in batches. In the *United States Army and Navy Journal* of August 20, 1881, in an article on "Managing pack-trains," occurs the following passage: "To each train is added a bell mare. Persons who are acquainted with the peculiarities of mules are aware of the extraordinary affection they entertain for a grey mare. The packers, to save the inconvenience of driving, and to keep the mules together, make use of one with a bell attached to her neck, and the mules when working at night, on or in deep and crooked trails, where they cannot see the mare ahead, will follow perfectly contented within hearing distance of it; but woe to the unfortunate packers if, by any accident, the bell ceases to be heard by the mules." Bell mules can be found either by ascertaining in purchasing the animals which have been used before as bell mules, or by noticing, when a number of mules are turned loose, the animal which a batch will principally follow. Driving mules cannot apply when they form part of the baggage train, or of a mixed convoy on the line of march, they must then be led by men on foot, and tied head to tail, otherwise they will cause impediment and confusion in the convoy.

Grooming once a day, in the morning, if stationary, in the evening after arrival in camp, if marching, has been found sufficient for horses and mules. The animals should be driven to water together, a mare with a bell round the neck leading; they will thus be free to drink what amount they need to quench their thirst, and will require fewer men to take them to water. The use of portable canvas mangers resting on legs in the form of an X is advocated to replace the nose-bag, as they keep the food from the ground, and if one animal does not consume his allowance the next animal will. In allowing the mules full liberty in feeding either in the stables or enclosure, the animals will abstain from overgorging themselves, and the cases of indigestion, so frequent amongst animals when picketed, will be

considerably lessened. Doing away with leading, the animals can move with greater ease, can keep their balance and recover themselves better, and fewer men are needed to look after a large number of them. Mules sleep three to four hours a day, the soundest sleep being taken about dawn. They have a bad habit of laying down and rolling whenever there is a halt; for small numbers the animals can be kept moving round in a circle whilst the troops halt to rest.

The following paragraph will be found in an order issued by the Quartermaster-General of the United States Army on the 23rd September, 1864, making known the rules approved of by the Secretary of War for the purchase of horses and mules:—

"Mules must be over two years of age, strong, stout, compact, well developed animals, in full health, free from any blemish or defect which would unfit them from severe work, and must have shed the four colts teeth, and developed the corresponding four permanent teeth, two to each jaw."

Mr. Harvey Riley, in a clever treatise on the mule with regard to those purchased at this period by the United States Government at this time, says: "A great many of the mules purchased by the Government during the war were entirely too young for use. . . . A great many of these small mules were but two years old. These animals were of no use to the Government for a long time."

Even with regard to three year old mules, he says: "Another point in that case is this; at three years old a mule is in a worse condition, generally, than he is at any other period of life. At three he is more subject to distemper, sore eyes, and inflammation of all parts of the head and body. He becomes quite weak from not being able to eat, gets loose and gaunt, and is at that time more subject and more apt to take contagious diseases than at any other change he may go through.* There is but one sure way to remedy this evil. Do not buy three year old mules to put to work that it requires a five or six year old mule to perform. Six three year old mules are just about as fit to travel 15 miles per day with an army wagon loaded with 25 cwt., and their forage, as a boy six years of age is fit to do a man's work."

A mule is hardly full grown until he is five years old; before that age he is not fitted for the hard work of military service.† Between five and six years is his best age for service; he should by that time be thoroughly broken, and he will then work hard for eight or nine years. At eight years the animal is fully formed, and in full vigour, and works well until the eleventh or twelfth year; he then begins to fall off. At fourteen or fifteen he is only fit for quiet slow work, but hardly able to withstand the fatigues of active service.

With reference to the animal's teeth at the age of four, the above writer says: "At four years the central nippers will be fully developed, the sharp edges somewhat worn off, and the marks shorter, wider, and fainter. The next pair will be up, but they will be small, with the mark deep and extending quite across. The corner nippers will be larger than the inside ones, yet smaller than they were, and flat, and nearly worn out. The sixth grinder will have risen to a level with the

* Old mules eat more than young ones; this is principally owing to bad mastication: the grain should be crushed, and salt given to help digestion.—G. A. F.

† From the commencement of the Transvaal disturbances in 1880 to the end of July, 1881, 1,663 mules were received at Newcastle, 216 of which, or 15 per cent. died. Of 353 South American mules which arrived there from Pietermaritzburgh in May, 1881, 11 were found two years old and under, 13 three years old and under, and the remainder were over three years old, but 200 of them were under five.

others; and the tushes will begin to appear in the male animal. The female seldom has them, although the germ is always present in the jaw."

"At the age of two years the tail reaches to the hocks, at three to half-way down the lower part of the legs, and at four to its full length; by these means the age of the *muleto* can be easily estimated without looking into the mouth."—(Sr. Don Miguel Vidaly Montenegro.)

The above particulars have been given, as it appears very important in obtaining mules not to purchase any animals but those which, by their age, which should be not under four years at least, are fitted for immediate and arduous work.

Where the animals are required for immediate work, broken mules only should be purchased; unbroken ones would be useless for transport purposes for some months.

The male animal can carry more weight than the mare, but mare mules are better than horse mules for draught and pack, as they are more docile; entire mules are vicious, and carry loads badly; entire mules are gelded to make them quieter, more docile, and silent, but this is accompanied by a loss of power in the back, less agility and slower movements, and the animals get sooner tired. Taking them all in all entire mules are preferable. For saddle, those that take more after the mare than the jackass should be preferred. The American War has proved that large sized mules are useless for army service, since they have not the same strength and endurance as the average sized animal.

Mules purchased for army service should be strong, stout, compact animals, in good condition and thoroughly sound. For draught, not under 14 hands high, and well broken to harness; for pack, not less than 13½ hands. They should be not less than 4 nor more than 9 years old, and suitable in every respect to stand the hardships of military service. Where the supply of forage is limited, small mules are preferable to large ones, for they require less food.

A great deal of patience is needed in breaking-in mules, for ill treatment will make them more afraid of man than they are already by nature. The breaking should be gradual; calmness and gentleness are very necessary. Ten days is considered sufficient to break a young mule in, working steadily and without haste. To break the animal in properly it is necessary to establish from the very first confidence between the animal and the trainer; men of irritable temper should not have this work to do. It is necessary to avoid allowing the animal to acquire a vice in breaking, for he will never forget it: good treatment is, after all, half the training. Once the trainer has gained the confidence of the animal he can do what he likes with him: well-bred and well cared for mules, which have been gently broken in, will be found almost as good and quiet as horses. The mule is easily frightened by noises and strange sights, and time should be given him to understand that these are harmless.

Harness for mules requires to be strong and well made, and the collars and pack-saddles should be very carefully fitted. The bit should not be too thin or braced too tight, for it will bring on a sore mouth, and this is a very difficult part to heal. If the mouth once gets sore the animal cannot eat or drink well, and will have to be put out of work until cured. De Cissey, Chief of the Staff of the 2nd Division of the Army of the East, advocated a joint pack-saddle and harness, whereby the draught mules could be used for pack when necessary. He says that African experience has shown that it is an error to believe that putting mules in draught incapacitates them for burden.

The principal points that demand attention in pack-saddles, are: imposition of weight on the part of the body alone which is able to

bear it, protection of the spine from pressure, strength of saddle to enable it to stand wear and tear, proper attachments of rings and hooks for the suspension of the loads, and such girthing as will prevent all swaying. In short, a good pack-saddle should be strong yet light, it should fit the animal for which it is intended, should be well stuffed, and the tree should rest clear of the backbone.

Amongst the best known and tried in our service is the Otago saddle, which was highly approved of in New Zealand and Abyssinia. It weighs 43 lbs., and, besides being good as a pack-saddle, also forms a fair riding saddle. Of 5,000 Otago saddles made for the Abyssinian Expedition, 4,000 cost £5 11s. 6d. each; the remaining 1,000 were paid for at the rate of £3 17s. 6d., though, eventually, 18s. 6d. per set was paid in addition to the above to the contractors, as they reported having lost by simply charging the above price. Otago saddles, and this applies to all pack-saddles, should be made of such a size as will correspond to the animals that have to use them. In the last China War, a strong, light, and easily-repaired pack-saddle from Manilla, made of bamboo, answered very well. The Catalan pack-saddle weighs 48 lbs., and costs about 2*l*.

The Punjab mule pad, which weighs 34 lbs., is simpler, lighter, and more economical even than the Otago saddle; it is easily repaired, capable of being fitted to animals of various sizes and in different states of condition, and packs on board ship with great facility. This mule pad was highly thought of in Abyssinia and in China. Appendices A and B contain reports on the pack-saddles and pads used in the Abyssinian and Afghan wars. Pads are more adapted for under-sized animals, whereas pack-saddles are suitable for strong, well-fed mules only. Pads are, however, easily repaired by native drivers and workmen—an important point on service.

The aparejo, which for small mules weighs 18 lbs., for bigger, 22 lbs., is much used in Mexico, and in some parts of the United States; it is a large pair of leather saddle-bags filled with straw (*see* description in Appendix C).

The pack-saddles in use in a country, however bad and unsuited they may appear to us at first sight, should not be hastily condemned, for, having been recognized by the people as best calculated for the purposes they require them for, may be found to answer after all: a fair trial therefore should be given them. In purchasing mules for the Abyssinian Expedition, "in every case where the mule had a pack-saddle, such pack-saddle was to be included in the purchase." If this had not been done, the animals might have been useless on landing for want of them. During the Zulu War the following item of news reached from Natal:—"The 'Ontario,' with mules from America, arrived at Natal; the animals are useless for want of harness." General Forey, during the Mexican War, complained of this same fact in a letter to the War Minister, dated 12th October, 1862.

With a large transport, often raised at a distance, it will be out of the question to rely entirely on what can be found in the country, as besides that the demand will be greatly in excess of the supply, time will not permit of entering into contracts for what is needed. We must therefore select, by the aid of experience, some serviceable description of pack-saddle or pad, and take out a large supply with us.

Whatever pack-saddle or pad is considered most advisable to use must be fitted to the animals, and each animal should be separately and carefully fitted, after which the saddles or pads should not be changed without sufficient reason. Great attention should be paid to keep the cruppers clean and well greased; in hilly countries mules suffer more from lacerated tails than from any other injury. Particular attention

at starting should be paid to the harnessing and loading; the load should be evenly divided to prevent its shifting, and the lower line of the load should be even with the shoulders. The packages should be short, for if too long they will distress and gall the animals. The drivers should not be permitted to ride on the loaded animals, nor should these on any account be either over-weighted or hurried on the march, as a want of proper attention to either of these two points may seriously affect their carrying powers for the future.

Appropos of this, Lieutenant-General P. H. Sheridan remarks:—

“When mules follow a scouting party which travels at a rapid gait, to keep their backs well is a difficult thing, and, no odds how well adjusted the saddle may be when the mule starts out, in a few days the fatigue and loss of flesh destroys the first adjustment of the saddle to the pack. I have packed extensively with skilful Mexican and American packers, with aparejos and pack-saddles, and have found the condition of the mules and the condition of their backs to depend very much upon the speed with which they were driven, and the roughness or smoothness of the country over which they travel.”

Expert saddlers are much needed, for if the animal gets too fat the pack-saddle is liable to hurt him; if, through work, his carcase gets smaller, the bigger gets the saddle for it. A good deal of the absence of sick animals depends on the intelligence and activity of the saddlers, hence no pains should be spared to get the best.

A thoroughly qualified superintendent should accompany each pack-mule convoy, he should principally superintend the putting on and removing of the pack-saddles, examine backs, attend to galls or sores on the animals' backs, and direct the repairs or re-stuffing of the pack-saddles to suit the altered condition of the animals.

The carrying power of the mule is generally over-rated. Mr. Riley, in his book, gives the experience of Mr. W. Anderson, one of the best mule packers in the States. This man in a journey he made in 1856, from the city of Del Norte to Chihuahua and Durango in Mexico, a distance of 500 miles or thereabout, found that, out of a train of 75 mules, the most it was possible for any mule to carry was 275 lbs.; not more than twenty mules could pack over 250 lbs., the average weight carried by the whole train being a little less than 200 lbs. The train travelled about 15 miles a-day, with a halt after seven or eight miles for the animals to feed.

In another journey, in 1858, Mr. Anderson found that some of the very best mules, out of a very superior kind purposely selected for packing, which were loaded with 300 lbs., gave out completely at the end of two weeks. He had again, in 1859, charge of a train of 50 mules, his average packing being 250 lbs. Mr. Riley says, “Anderson asserts it as the result of his experience that, in packing 50 mules a distance of 300 miles with 250 lbs., the animals will be so reduced at the end of the journey as to require at least four weeks to bring them into condition again.” These trains moved under the most favourable conditions; the animals were not loaded a long time before starting, they had not the long halts to make which generally take place when following the troops, were well fed, and the best care was taken of them, and, notwithstanding all these advantages, it was found that a little less than 200 lbs. was the average weight of load allowable.

“A good solid compact mule, when well broken, properly fitted and handled, will carry in ordinary field service 30 per cent. of its own weight. If the load is in proportion to the size of the animal, small mules have the advantage: 1st. Small loads do not have to be so carefully balanced. 2nd. Being lighter they are not so apt to mire down.

3rd. In all markets there are three or four small to one large mule, increasing to this extent the chances to secure well-formed, compact animals. All packers agree that a 900 pound mule is quite as good for a 270-pound load as a 600-pound mule is for a 200-pound load."—*Thomas Moore*. With regard to the animal's weight Harvey Riley considers that a mule $14\frac{1}{2}$ hands high to be in good working condition should not weigh over 950-pounds; one 15-hands high, not over 1,000 pounds.

Colonel, now Sir Charles, MacGregor, in his *Narrative of a Journey through the Provinces of Khorassan, etc.*, says, "A Persian mule will carry 3 cwt. over the worst roads, and so continually." Three hundred and thirty-six pounds appears to be a very extraordinary weight for a mule, and is certainly more than what the carrying powers of the very best mules are credited with.

Mules show by their gait when they are fatigued, they should therefore be carefully watched so as to abstain from pressing them when they show signs that their strength is exhausted. A tired mule droops his head, his neck assumes a horizontal position, and his ears drop back. As long as he is in strength the ears remain erect and inclined to the front; as soon as he begins to fan his ears, it is a sign that fatigue is beginning to tell on him.

During the Peninsular War, mules were hired by the Commissariat for a Spanish dollar a-day, and rations for the driver. When the hire was irregularly paid, 5 lbs. of corn were issued for each animal. The weight of load was fixed at 200 lbs., and the length of journey, in a mountainous country with bad roads, was from 10 to 12 miles loaded, 15 to 16 unloaded. The maximum price paid for mules purchased for the Bhootan Expedition was 180 rupees, those purchased at Bagdad and Bushire for the Abyssinian Expedition averaged 124 rupees 8 annas, to which were added 50 rupees for each animal delivered alive in Bombay. The mules purchased in the Punjab for the same expedition cost 225 rupees each, those purchased in Egypt were paid for at the rate of 26*l.* 10*s.* per animal. The mules purchased in New York for the Zulu War were most of the Kentucky breed; the offspring of nearly thorough-bred mares called "Kentucky trotters," and cost 42*l.* per head.* A firm in London at the same time tendered to supply mules from Spain at 35*l.* each for pack, and 37*l.* 10*s.* for draught. The Colonial mules bought during the Zulu War cost on an average 23*l.* each.

Maize and hay or dried grass forms a most wholesome and nutritious food for mules. Veterinary Surgeon B. L. Glover, R.A., who assisted in the purchase of mules for the Army Service Corps effected in the United States in 1880, says: "With reference to the feeding of mules in the United States, I may mention that they generally in towns receive a mixture of maize and oats in the proportion [of 1 to $1\frac{1}{2}$], the quantity of this mixture varying, according to the size of the animals, from 4 lbs. to 10 lbs. per day. Together with this grain ration from 6 lbs. to 12 lbs. of hay is given, and with small mules it is very often the case that they are only fed twice daily, viz., morning and evening.

A remark of an experienced American of New York, quoted by Veterinary Surgeon B. L. Glover, deserves being recorded here. He said, "I always looked after my mules, and gave them ordinary care; I never pampered them, for if they get too much looking after their constitutions become comparatively delicate, and makes them less able to endure hardship and privation, the one great attraction in a mule."

* Good serviceable mules can be purchased at St. Louis, United States for from £25 to £30.

Ponies.—Pack ponies are nearly as good as mules for transport purposes, if the saddles are made to fit them carefully in the first instance. Those from the hill districts in India, small but stout, with strong limbs, are very good; they should be driven as recommended for mules. The ponies from over the North Western frontier of India and from Pegu will carry as heavy a weight as the largest horse.

Ponies for hill work, for they are seldom used for pack except when required for work on difficult ground, should be of moderate size, compact and stout built, capable of enduring much fatigue. The points to look for in them are strength, power of endurance, and good temper; above all, they must be surefooted. The ponies purchased for the Bhootan Expedition cost 120 rupees each, those obtained in the Punjab for the Abyssinian Expedition were purchased at 150 rupees each.

Donkeys are capital animals for transport, if not worked too young, and if of good size and breed; they are enduring, do not require much food, and four or five can be placed in charge of one man. The ass is surefooted and easily maintained; the Spanish is double the size of the ordinary English, and in the Island of Bahrein, in the Persian Gulf, there are donkeys exceeding in size those of all other countries. As a general rule, the ass is large and sleek-haired in warm countries, small and woolly-haired in colder ones. Asses are used more in the East for carrying burdens and for saddle than in Europe; they are much used in Egypt and Syria, and those of Bagdad are quite famous.

The load for a donkey should never exceed 100 lbs., and none under four years of age should be purchased for immediate service.

*Camels.**—The camel is called the ship of the desert, for it would be as impossible to cross deserts without camels as the sea without ships. Camels are used in India more than any other animal for military transport purposes. There are two species of this animal, the common or Arabian camel, which has one hump, and is now largely domesticated in India, and the Bactrian, which has two humps, and is found in colder climates. The Arabian is the more valuable of the two, and can store up a considerable amount of water for future use. Once accustomed to travel across the arid and sandy deserts and wastes, experience teaches him to lay by a greater store of water than would be stored by a young and untried animal.

A large camel of this kind, taking five or six gallons of water into his stomach, is supposed to be able to remain for five or six days without drinking. Hence, where water is scarce, the camel, being able to go longer without it than any other animal, is most adapted for transport purposes. As a rule, the store of water the animal is supposed to carry is greatly exaggerated; in hot weather the camel requires water every day, in cold he begins to fail after being three days without it. Much depends also on the kind of food he eats, as he will require less water when fed on succulent green food than when kept on dry bhusa.

Camels receive no injury to their palate from the thorns and hard food they eat, but they are naturally slow feeders, and require therefore plenty of time to graze.

The favourite food of the camel (see *Steppe Campaigns*) is worm-wood, thistles, and coarse prickly and saline grasses. General Koorapatkin, speaking of the camel train in Algeria, gives the following plants as those most used for camel food in the greater and lesser Sahara.

“Getaf (a bush growth), *antriplex habyms*. Grows on a salt

* The following works contain valuable information on camels: “Du dromadaire comme bête de somme et comme animal de guerre; par J. L. Carbuccia.”—“Mémoire sur l'histoire naturelle du Dromadaire; par M. Vallon.”

impregnated soil, and has a saltish taste. A favourite food of camels and sheep.

"Rtem (a leguminous growth), *retama durizi*. Fought for by camels and goats.

"Drin (a grass), *arthrateris pungens*. Grows on a sandy soil.

"Boo-griba (a grass). A very succulent plant. Grows on a salt-impregnated soil.

"Diel (a bush growth), *atriplex inolliz*. A very widely diffused plant. Reaches a height of $1\frac{1}{2}$ feet, but it then almost ceases to be eaten by camels. It is used as fuel.

"Sooid (a bush growth), *chenopodium vera*.

"Shiye, *artemesia herba alba*. A very widely diffused plant.

"Alfa (a grass), *stipa tenassima*.

"The last in importance occupies the first place. Covering as it does hundreds of square versts, the alfa serves as the food of camels, horses, sheep, cows, and goats."

The principal camel food in India (according to Boswell) is pilchi, *alias* ghow, *alias* garash (tamarisk). Pushtu name, ghaz.

Gowassa or jowain (Pushtu, zaz), beaten up when dry into bhusa, is preferred by camels to white bhusa. Should be collected in October or November for the winter.

A plant, called in Pushtu zmai, about Kuchtak and Hykalzai.

Khinjak.

Lahma.

(According to Yaldwin): trees and shrubs, peepul, neem, goolur (kikur or babool), phulai burgut, jhand, goolalee, hees, kurrul, jawassa, lana, jaree, karonda, kair, kateela, behr (neem and babool are the most nourishing); young khaweed or kusseel, mote sarson and taramera in their proper seasons.

The Bactarian camel is quite at home in a cold climate, and walks over ice as easily as its congener does over smooth stone; he is an admirable rock climber, and is said to surpass the mule in the sureness of his tread. This quality is probably occasioned by the peculiar structure of the foot, which has an elongated toe, projecting beyond the soft pad and forming a sort of a claw. In the winter time the riders prefer them much to horses, because their long legs enable them to walk easily through snow in which a horse could only plunge helplessly, and would in all probability sink and perish. A mixed breed of the one-humped and the Bactarian animal is thought to be the best for hill work.

General Harlan actually took 2,000 of these animals in winter time for a distance of 360 miles, over the snowy tops of the Indian Caucasus; and, though the campaign lasted seven months, he only lost one camel, and that was accidentally killed. Owing to its use amongst the hills, the Bactarian is sometimes called the mountain camel. Three days is considered the longest a Bactarian camel can go without drinking.

The mixed breed which is advocated between the Bactarian and Arab animals must be procured from a male Bactarian and a female Arabian camel. If the parentage be reversed the offspring will be useless, and will be found ill-tempered and disobedient. The Bactarian camel is, as has been mentioned, tolerant of cold, and is indeed so hardy an animal that he bears the severest winters without seeming to suffer distress, and has been seen quietly feeding when the thermometer had reached a temperature several degrees below zero. Sometimes, when the cold is more than usually sharp, the owners sew a thick cloth round his body, but even in such extreme cases the animal is left to

find his own food as it best can, and, however severe the weather may be, the Bactarian camel never sleeps under a roof.*

The weight of a full grown camel is about 10 cwt., his average length from nose to tail, 8 feet, the ordinary height 7 feet at the top of the hump. The highest speed of a lightly-loaded baggage camel is three miles per hour, but as a general rule it does not do to reckon on more than from 2 to 2½ miles. A *heirie* or swift riding camel seldom does more than 8 miles per hour, but the animal is so enduring that he can keep up that pace for many consecutive hours. The stride of the camel varies from 6 feet 6 inches to 7 feet 6 inches; his feet are well adapted to obtain a firm hold of the shifting sand, but he is a bad mover over sharp, stony, wet, or slippery ground; on wet ground he cannot obtain a secure hold, he either falls, or his legs separating suddenly wide apart cause him fatal injury. The camel sometimes lives from 30 to 40 years.

Camels can carry a load of from 320 to 450 lbs., according to their size and strength;† they are cheap to maintain, are easily fed and managed; they are, however, difficult to transport by sea, are delicate animals and require careful looking after and doctoring. Sir Charles Napier says: "The treatment of sick camels appears to be little understood‡ Camels, when overworked, rarely recover, as horses and other animals do by rest, they are generally observed to become daily weaker till they die." This fact was confirmed in the advance of General Stewart's column on Candahar, when the expectation of the camels picking up after a short grazing in the Peshin valley and recovering from the fatigues of their march in Kutch and through the Bolan Pass was not realized, and a large number died. When a camel ceases to eat, either on the march or in quarters, it is a sure sign that he is ailing, and when worn out by overwork he requires at least six months to recover condition.

Young camels are unfit for rough continuous work; and all camels, as a rule, are in a bad condition for hard work during the time they are shedding their coats.

The camel of the plains is unadapted for climbing hills, owing to a want of muscular power in the hind legs; the hill camel is more proportionate, therefore better suited for hill work.

The lowland camels cannot stand the severe climate of cold countries, and, *vice versa*, the hill camels suffer a good deal from the heat of the plains. The great mortality amongst camels in the two Afghan campaigns, in Scinde, and in Abyssinia, was principally due to this fact; though, in the first Afghan campaign, they approached the cold climate in any but a good condition, weakened by a very long march. The Russians in their expedition to Khiva lost a very large number of camels from long continuous marching without an occasional halt to enable them to recruit their strength. The animals require a rest of from 30 to 40 hours after four or five long marches; but, not to

* Some of these particulars regarding the Bactarian camel have been obtained from the Rev. J. G. Wood's interesting book "Bible Animals."

† The Russians lay down the weight of load for a camel at 700 lbs., and give 800 to 880 lbs. as the weight with their traders' caravans. See "Steppe Campaigns," page 61.

‡ What Sir Charles Napier, referring to India, said about the little knowledge in the treatment of sick camels, applies likewise to other countries. In a work on Algeria by the Russian General Koorapatkin (see *Army and Navy Magazine*, Nos. 14 and 15) in speaking of five of the principal diseases of camels (one being colic) he shows that the usual Arab treatment is firing. This is akin to the Indian treatment for bullocks, which, in some parts of India, is carried to such an extent, that the bullocks are scored all over the body with marks, showing how merciless this inhuman treatment has been resorted to.

wear out their constitutions, their employment on the staging system, which secures them comparative rest every other day, is recommended.

As a baggage animal in a level country, working leisurely between depôts or with the reserves, the camel is invaluable, but he is ill-suited at all times to accompany an army making long and rapid marches, for which purpose mules and ponies will be found preferable.

A camel can carry as much as two and a half mules or ponies, and his ration is about the same as for one of the latter, also one *surwan* can look after four camels, whilst three mules is as much as a man can look after; hence, with regard to pay, clothing, and feeding, the camel is the cheapest. With an equal amount of stores to carry, mules or ponies extend twice as far as camels on the line of march.

Napoleon formed a dromedary corps for his expedition to Syria. Following his example, when Sir Charles Napier found himself at the head of an army in Scinde (a country well adapted for camels), he raised a camel corps, which was revived during the Indian Mutiny and did good service in the Central India campaign. Each camel carried a driver and an infantry soldier; the camel corps could make very long marches, at the end of which the soldier, comparatively fresh, could dismount and fight on foot; making it therefore impossible even for the lightest of the enemy's troops to try and escape.

The camels, if attacked by superior numbers, could form a ring facing inwards, and the drivers, who were also armed, could keep the enemy off from behind this living redoubt. As the camels carried the men's kits, provisions, etc., the corps was rendered free of all *impedimenta*.

The following extract from Sir C. Napier's "*Administration of Scinde*," shows how useful a camel corps can become on an emergency:—

"No sumpter camels had yet been procured, and the General thus pushed to the wall detached Fitzgerald's fighting camel corps to fetch food from Shahpoor, with orders to scour the ravine of Tonge once more during his march, and even attack the place if it contained enemies. The military excellence and power of this anomalous corps were then strikingly shown. With hired sumpter camels the marches alone would have occupied six days and nights; and a strong escort must have been employed to protect the convoy. Fitzgerald's men, self-supported as a military body, not only scoured the ravine and reached Shahpoor in one night, after a march of 50 miles, but loaded their camels with 45,000 lbs. of flour, and regained camp on the morning of the 8th, having employed but three days and two nights in the whole expedition!"

Camels have been used to convey reinforcements rapidly on an emergency, two men riding one on each side in kajawahs. Kajawahs is the name of a description of hamper used for carrying fruit and goods in Afghanistan. In India, a modified kind of this hamper is used to carry the companies' cooking utensils in European regiments; it consists of large open box with a wooden framework, about $4\frac{1}{2}$ feet long by $3\frac{1}{2}$ feet broad, the sides of the framework being covered with rope matting or coarse gunny cloth. Sick men have been carried in the regular native kajawahs, but the rough motion of the camel backwards and forwards at every step the animal takes, makes this mode of transport very uncomfortable for sick men.

Another, however, and a very important use to which camels have been put, is the forwarding of letters and despatches by means of riding camels. These animals will trot seven and more miles an hour on fair roads or suitable ground, and will keep that pace up for many miles without showing the least sign of distress. Most corps of Native

cavalry in India are provided with one or more *shooter sowars* per troop for this duty.

With the army of the Indus in the first Afghan campaign there was a field battery of 9-pounders drawn by camels, and Sir Charles Napier, in his march to Emaunghur had also a camel battery with his force. A particular description of camel, called the *bangree*, is employed for draught. The first battery of this kind was raised by Major Pew, of the Bengal Artillery. Four camels were attached to each gun and limber; but it was suggested during the operations in Afghanistan, where the battery was first used on service and found to work well, to put six camels to each gun and limber, and to carry the ammunition on pack camels in place of in tumbrils.

Light field-pieces are also carried on camels, four animals being told off to each gun—one for the piece, one for the iron carriage, one for the wheels, loading rods, etc., and the last for a pair of ammunition boxes.

These various uses to which camels have been put do not strictly come under the head of transport, but are mentioned here to show to what uses these animals can be turned in countries suited to their movements. The advantages that they possess in such countries are that they can go longer without water than the horse or mule, in most of these they are easily fed, no forage having to be carried for them, and they are not harassed by extreme heat. Camels, however, cannot be overloaded without their health suffering, they require sufficient rest and plenty of time to graze sufficiently.

The great mortality amongst camels both in the first and second expedition to Afghanistan might leave on many minds a wrong impression of the value of this animal for military transport purposes, it may be as well, therefore, to show some of the causes that have done much to produce this excessive mortality. The lowland camel cannot stand the severe climate of a cold country, and in both instances he was called suddenly to face it with a constitution impaired by long toilsome marches, during which he suffered from want of sufficient food, water, and rest. Considering the thousands of animals that moved on the same road, and that the lowland camel refuses to eat the forage the up country camels thrive on, the grazing close to the regular halting places was soon exhausted, hence the animals after arrival in camp each day had to be taken further and further off to graze. Laying aside the fact that the driver little relishes after the toils of a long wearisome march to take his animals 5 or 6 miles off to where he can find sufficient fodder (a fact which, of itself alone, would add from 10 to 12 miles to the length of the day's march), the animal arrived on the feeding ground at so late an hour in the day that, being a slow feeder, he had to be driven back to camp before having taken in nourishment in any way commensurate with the hard work he had daily to undergo. Thus toiling day after day under the same conditions, without a rest, travelling over bad roads, shorn of the hairy protection given to him by nature, and, though weakened, being allowed no corresponding reduction in his load, he reached the high country about Quetta, where the severe climate soon laid hold of him and rendered him useless to the army; and, as we have seen that he does not recover as other animals do by rest, he was soon lost altogether.

The loss of camels in the first Afghan expedition, according to Hough, amounted to nearly 26,700; in 1878-79 the mortality was not so great, but the mortality did not represent the actual loss in transport power, for many animals became sick and totally unfit for work and did not recover with rest and good grazing.

A great cause of mortality was the neglect and indifference of the sur-

wans; their cruelty and neglect cannot be exaggerated: it has been repeatedly asserted that the attendants were the worst enemies of the animals. The certainty of the forthcoming compensation in the event of death was also an incitement to neglect. Irregular, insufficient, unsuitable food were the principal causes of loss. Want of proper food accompanied by exposure debilitated the animal and prepared him for disease.

The loss in animals (principally camels) in the last Afghan war is put down to about half a million of money (the Punjab and Scinde having lost one-third of their carriage) and is accounted for principally from bad selection, want of proper supervision, continuous work, insufficient clothing and food. The mortality could have been reduced by the introduction from the very beginning of a staging in place of a through system, which would have given the animals a comparative rest every other day. Some arrangements might also have been provided for all cases where forage close to camp was scarce or exhausted, such as an allowance of ghee and flour, which are good substitutes for forage. The Russians in their expeditions in the steppes found it a good plan to allow each camel a daily ration of 3 lbs. of meal and 3 ozs. of salt. However, in the Afghan War there were already difficulties enough in providing rations for the men, and forage for the horses, without employing part of the transport to carry food for the transport animals.

The unfitness of the camels from the plains of India to stand the climate during the winter months in Afghanistan was fully recognized before the beginning of the operations, for in some printed instructions issued to the staff by the Quartermaster-General's Department containing all kinds of valuable information regarding the country to be traversed, the necessity of procuring suitable hill camels in the country above the Pass was forcibly recommended. Good hill camels were sold in the Peshin valley to officers of the Candahar column in 1878, for from 50 to 80 rupees, but at first steps were neglected to make a large acquisition of these animals for public transport. The price of a baggage camel in the plains of India is from 60 to 70 rupees in peace time; during this war it was rated at from 80 to 100 rupees. Good camels are to be purchased in Turkish Arabia, and in Anatolia the best breed, the cross between the Bactarian and the Arab camel, is it to be found. In Mesopotamia good Arab camels can be bought for 7*l.* or 8*l.* a piece.

Camels should not be used for severe work before their fourth or fifth year. The allowance of water for each animal is 7½ gallons per diem. "Rum has a marvellous effect on camels in cases of exhaustion, and a supply for this particular purpose should always be allowed and be at hand." (Major Sir B. P. Bromhead 40th N.I.). "If a camel is utterly done, and refuses to rise, try the effect of giving him a bottle of rum."

Bullocks are used for draught as well as for pack; the movements of draught bullocks are very slow, their pace hardly exceeding 1½ mile per hour. In steep ground they take three times as much as horses in ascending, and twice as much in descending; in moderately undulating country they take twice as long as horses to cover a certain distance. Bullocks will draw heavy weights up steep inclines, but they have little control over their legs in descending. The slow pace of this animal renders him unsuited for employment in the first line of transport. Bullocks drawing heavy loads, though they move slowly, get through a deal of work upon a small quantity of food. In the Peninsular War one pair of bullocks was considered to be able to draw the load carried by three mules, though it was recommended not to trust their capability to any further extent than to be able to draw a load equal to that carried by two good mules. A pair of bullocks on good

roads will, however, draw a load of 800 lbs., which equals the amount carried by four mules. Pack bullocks will carry about 160 lbs., moving under that load at the rate of two miles per hour.

Oxen are patient, enduring brutes, but full of aggravating ways; they are very sagacious, and often are very tedious and difficult to put to, for, just when required to be quiet, some animal will become intractable.

During the Indian mutiny a bullock train was organized to hasten the movement of the much needed reinforcements up the Grand Trunk road. A cart with canvass top and sides drawn by a pair of bullocks was told off for each six men, of which four were accommodated in the cart and two walked alongside it, changing places alternately. Reliefs of bullocks were placed along the road and enabled a good many miles to be travelled over in the twenty-four hours.

The Duke of Wellington, in his campaigns in India, at the commencement of the present century, had most of his transport done by pack bullocks, but his despatches are full of complaints against the Brinjarees (a special caste of carriers from Bundelkund, whose occupation consists in conveying large quantities of grain over a great portion of the Indian Peninsula by means of pack bullocks), who supplied him with cattle, and go clearly to show on what a precarious transport his military operations were carried out, as the men, though well treated, broke their engagements, sold the stores confided to them, and deceived him in every instance.

Bullocks are much used in some parts of India as pack animals, but are not desirable as military transport in difficult countries as they move slowly and soon fall into bad condition if not supplied with abundance of food and water. The animals will straggle in search of forage and cause thereby serious inconvenience on the line of march. Bullocks are good for draught when no particular speed is necessary and require no harness. When they are used in draught they are found to pull better in swampy countries, having more endurance than any other animals. Bullock carts also carry greater loads than horse carts.

Bullocks work best under drivers they are accustomed to, it will be therefore a great point to entertain the two together. In a warm climate the precaution of watering bullocks in the middle of the march should not be neglected or the animals will lie down and will be made to move on only with difficulty.* Their allowance of water is 5 gallons per diem.

Notwithstanding that the loads were light and the marches short, the mortality in bullocks during the Zulu War, particularly in the 1st Division, was very great. This was partly due to a severe season with heavy rains and very cold nights, an insufficient number for the work to be done and to form a reserve to allow an occasional repose to those debilitated by work and climate, insufficient grazing, improper selection of cattle (the up-country bullock not being suitable for work in the districts lying near the coast), the wretched condition of the only cattle available for constant work, want of sufficient and experienced drivers and of officers experienced in ox transport, and, above all, working the cattle in a deadly climate at a season of the year in which experience had proved that oxen cannot be worked without suffering severe losses.*

* Oxen in Natal died of a disease called "red water." During the Zulu War in one convoy that went from Maritzburgh to Greytown, out of 120 bullocks 43 died; most died within 48 hours after leaving Maritzburg. The animal is perfectly well to-day and does his work, he sickens in the same evening and is dead the next day. Red water is a blood disease, chiefly affecting the digestive organs, prevalent between November and April, particularly when this season is very wet. In a snow storm on the 26th April, 1881, near the Umvelosi River, out of 990 oxen, 320 died. In the same storm at Newcastle, in two days, 879 oxen and 5 mules died.

During the first rains which follow the dry season in South Africa, when grass is scarce, a plant of the tulip family shoots up, which is eagerly eaten by the cattle, and is very destructive to oxen; the only remedy is to keep the cattle well together and to pay great attention to what they eat.

Elephants are largely used for military transport in India. The female animals are preferable to the male, as these last are liable to get "musty" and give a deal of trouble whilst in that state. With a load of 1,200 lbs. the pace of an elephant generally averages $3\frac{1}{2}$ miles per hour.

On service they are useful in drawing heavy guns and mortars, and have also been employed in carrying troops on an emergency, each elephant carrying six men sitting back to back, two on each side, and one in front and one behind. They are also particularly well adapted for carrying the large and heavy tents used in India.

Sir S. Cotton, in his *Nine Years on the North Western Frontier*, says he prefers elephants for carriage even in a mountainous country; however in such a country elephants are slow movers and are apt to get foot-sore. In Abyssinia they carried the mortar battery and Armstrong guns, carriages, limbers, and ammunition over the difficult and mountainous parts of the road, the loads varying from 8 to 16 cwt.

Elephants require clean and wholesome food in sufficient quantity and at such a time as will not interfere with their rest at night. They should receive plenty of green food, which, however, is not equally procurable in every country. During the cold and wet seasons they should be picketted in a dry and open spot, and in the hot months they should be sheltered if possible. They should be washed and watered twice a day; each animal will take about fifteen gallons at a time and cannot go without water for more than twenty-four hours without injury.

If no trouble should be spared in collecting a large number of serviceable transport animals, it stands to reason that no trouble either should, be spared in keeping them in good condition. If they are neglected economy in transport will not be secured, for more animals will be needed for a certain work and the risk is run of utter collapse. It should be a maxim to feed and care your animals well that they may serve you well.

To keep baggage animals in good health and in thorough working condition it is particularly necessary to have good drivers—men who possess a fair practical knowledge of the animals they have to attend on, and who thoroughly understand how to load them. So impressed is the American Government with the necessity of employing good mule drivers that they pay the civilian packers employed in their expeditions on the Pacific slopes of the United States, from 150 to 300 dollars a month. We gather from an American writer that a packer "to become thoroughly competent must have at least three years' practical experience; every year's additional experience will add materially to his intrinsic value. His abilities require to be so varied, that he must be competent to perform the duties of veterinary surgeon, farrier, harness maker, and cook." If three years is considered by them necessary to make a good packer, how can we expect anything but sore backs and poor condition, when in our expeditions any man is deemed fit, whatever his calling, to be turned into a driver.

No more animals should be placed in charge of one man than he can well look after. Elephants require a *mahout* or driver and a boy; one driver is necessary for each two ponies, mules, and

draught bullocks, though, sometimes, to reduce the number of followers, three ponies or mules are assigned to each man. One *surwan* can attend to four camels (the Russians allow but one driver to every six camels); one attendant can look after five or more donkeys; experienced drivers are needed for pack bullocks and one good man can look after a number of them. Proper interpreters to convey orders and instructions to foreign drivers and to make their complaints known to the officers are indispensable. These should be all reliable men to ensure the orders being properly communicated.

A deal of time is needed to become expert in leading and looking after pack animals, and their loading requires practised and skilled hands. When the transport is principally improvised from the materials found on the spot there will be a greater necessity for well trained officers and men to supervise it.

In the expedition to Abyssinia a line regiment in the Bombay Presidency, finding itself not detailed to form part of the expeditionary force, volunteered to go there to look after the transport: the offer was not accepted, though later on it was acknowledged that it might have been accepted with considerable advantage. In the late operations in Afghanistan the services of the 30th Regiment Bombay Native Infantry were asked for to undertake the charge of the transport animals. In India volunteers from the carrier castes might be demanded from the army to take charge and drive the pack animals; this would make the transport more orderly; the men would be already broken to discipline and trained to defend themselves; it would give an accession of strength in fighting men if needed; it would be more economical, for a slight increase to the soldier's pay only would be necessary, if many would not volunteer even without this inducement for a change and to see service; the experiences of the war would not be wasted on a mass of civilian drivers, but would be extended to a larger number of trained men; lastly, if the animals died there would be no useless mouth to feed, but soldiers returned to the ranks.

The peculiar habits of native drivers should be studied, and their feelings and prejudices, instead of being offended, should be turned to good account. We should avoid interfering with their peculiar ways of working, as long as these meet our requirements, and abstain from condemning without a fair trial any peculiarities of theirs. To introduce suddenly our customs and ideas in a stubborn and conservative class of people can only cause friction: to adopt any radical deviation from the usual custom, whilst the transport is at work, can only lead to confusion and discontent, and endanger the efficiency of the same. Superintendents of their own nationality should be employed as much as possible, and the men should be secured from unnecessary harshness from our non-commissioned officers and men. Large numbers of native drivers are indispensable; all we have to do is to combat their laziness and carelessness, and to prevent, by the absence of proper care on their part, any loss of animals or partial breaking down of the train, and for this a proper organization is absolutely necessary.

The great advantage of having officers and non-commissioned officers acquainted with the language and customs of the men would be attained in any expedition sent to Egypt, the Persian Gulf, the East Coast of Africa, Burmah, and China, by employing exclusively superintendents and drivers from India, independent altogether as to whence the animals come from. Some excellent muleteers are to be found in the Punjab, and the Jat and Lobana castes of Sikhs possess in a high degree the useful knowledge of lading and tending beasts of burden. India can furnish an ample supply of men for transport duties, men with whose habits, language, and customs our officers are familiar.

Foreign drivers have never been found hitherto to answer, as, for example, in Abyssinia, where they had to be discharged. Should mules be obtained from Persia real *Katirchees* should be enlisted in that country and afterwards placed under an Indian officer acquainted with the Persian language, not a difficult thing to find. In the Zulu War it was found a serious drawback, the officers not being able to speak the language of the drivers.

Equipment required for various kinds of Animals used for Military Transport in India.

For Ponies and Mules.

Head stall with chain or rope.
 Heel rope or chain with shackle.
 Blanket (or *jhool*) with surcingle.
 Nose-bag (or *thobra*).
 Pegs, iron, 2.
 Mallet, iron, 1 for three animals. Wooden, 1 to 50 animals.
 Loading rope.
Sulletah.
 Pack-saddle or pad.
 Bridle.
 Curry-comb.
 Hand rubber.
 Brush.

For Pack Bullocks.

Tara, or saddle with slit in the centre.
Petarraha, or saddle pad with tail band.
 Surcingle, or belly band.
 Head ropes with loop at one end.
Saleetah, or satchel for baggage, etc. : or *Koorjee* (saddle bags) for cooking utensils.
Pal lined with blanket, or small tent.
 Line rope, double, of hemp for every 50 bullocks.

For Draught Bullocks.

Juttran (or *juttram*) yoke rope of twine webb, $2\frac{1}{2}$ -feet long by $\frac{1}{2}$ an inch.
Nari, or cross bar ropes, 9 by $2\frac{1}{2}$ inch in circumference.
 Leading ropes.
 Driving ropes.
 Nose ropes.
 Picketing ropes.
Jhool, or covering.

For Camels.

Saddle (*pillan* or *pu'an*), weight 21 seers (42 lbs.).
 Cotton belly band, $13\frac{1}{2}$ feet long $1\frac{1}{2}$ inches wide.
 Loading rope, 45 feet long $2\frac{1}{2}$ inches in circumference; weight, 4 seers (8 lbs.).
Nakel, nose peg.
Gorbund, breast plate.
Doomchi, crupper.
 Head stall, etc., weight 1 seer (2 lbs.).
Daman, picketing rope.

Mahar, or *mahar*, nose rope.

Sulletah for 10 per cent. weight 8 seers (16 lbs.).

Suffra, feeding bag.

Jhool, weight 8 seers (16 lbs.).

Total equipment weighs about 1 maund and 2 seers (84 lbs.).

1 shear to 25 camels.*

Wheel Transport.—As two horses can draw at least as much as eight pack animals can carry, this alone will show what a saving of animals, drivers, food, and forage can be obtained by the use of wheel transport in all countries which are intersected by good roads.† In such countries this description of transport will be found preferable to any other, and will tend largely to reduce the length of the transport train of an army. Take, for example, a string of camels on the march, the length of a camel and interval between each two animals is reckoned at from five to six yards; three such animals will take more room in length than a four-horse wagon, yet carrying less than half of its load. The difficulties of the transport, the safety of the train, and the time occupied in transit, increase with the length of the train; it is above all necessary to reduce the time occupied by the train in transit, for the longer it takes to go from camp to camp, the longer the troops will remain without their necessities and the less time the animals will have to feed and rest. This latter is a point of great importance. Carts and wagons are, besides, more orderly on a road than long strings of pack animals, and, though subject to breakdowns, and requiring good roads, come in very useful for the purposes of defence. The efficiency of the transport will greatly depend on the nature and state of the line of communications; as long as there are good roads wheel transport should be used, pack transport only being employed where carriages cannot move.

We have become somewhat familiar of late with bullock transport, owing to the accounts received from the seat of war in Natal. Such lumbering vehicles, drawn by 12 or 16 oxen, totally opposed to the accepted ideal of a military transport wagon, used and worked together in very large numbers, added considerably to the difficulties of the campaign. It was, no doubt, the carriage of the country, but in modelling the military transport on that of a country, some limit must be recognized. The train moving with one of our small columns at the commencement of the war occupied five miles of road in a country presenting to the enemy facilities for attack. Guarding such a large number of cattle as these wagons required, when out grazing, was also a considerable difficulty.

Loaded carts can be got ready and started much quicker than pack animals, as with the latter the first loaded have to wait under a load until the whole are loaded and ready to move off.

Carts with two wheels are generally intended for draught by one animal, wagons with four by two or more animals. Light carts possess several advantages over wagons, for instance, they can travel over secondary roads where heavy wagons cannot go, are easier driven, require less room to turn round, can be helped easily by a few men out of any difficulty, admit of a large weight being subdivided amongst them, and can carry a larger quantity of articles, for it will

* Two seers mustard oil and 2 chittacks of brimstone for each camel for oiling are required.

† "The effective wagon load being from 25 cwt. to 30 cwt., and the average load of a pack-mule, exclusive of the pack-saddle, 160 lbs. or thereabouts, it follows that a wagon carries as many rations as 16 or 17 pack-mules."—*Lieutenant-Colonel Clifford Parsons.*

be found that four carts carry a greater load than what is conveyed by a single four-horse wagon. Carts, however, are more liable to be upset by careless driving or irregularity of ground, and have no mechanical means whereby to check their progress when going down steep inclines. As the weight of the load also rests only on two points the roads are sooner destroyed than where carriages with four wheels are used. Two-wheeled carts are convenient, and easy to draw on level ground, but are unsuited for hilly countries, particularly for those where the slopes are steep. The load is generally either too great or improperly balanced, and this prevents an animal getting a firm hold of the ground in moving up hill or presses unduly on him in descending. The testimony of many German, French, and Russian officers goes to show that two wheeled carts have serious difficulty in getting over bad ground, and moving both up and down steep hills, and their employment in any but level or slightly uneven countries is by them generally condemned. The more carts are needed, the more men will be required to look after single animals; on the other hand, these can be led by hand, which will be so much gained in the amount of useful load the animals have to draw.

The description of wagons and carts to be used on service will depend upon a variety of circumstances, and it is on this account that in almost every expedition we see a different kind adopted for transport purposes, although all, no doubt, possessing special points of recommendation in their favour in their respective localities. As countries differ greatly from each other, their nature, the description and general state of the roads, the description of draught animals to be employed, and the habits of the inhabitants, are so many points to be considered in determining on the most appropriate kind of wheeled transport suitable for each case. As a general rule, if made much after the pattern of that used in the country itself, and horsed in the same way, it will be found to answer well, as experience has clearly demonstrated that the best means of transport to employ in war are those which are in use in the country itself.

"The general carriage of the country in which an army is campaigning should be used as much as possible, not only because it can be more easily replaced, but likewise that it is generally more suited to the locality, and is sure to be better acclimatized, and consequently more healthy; therefore, however inferior it may appear, yet, as a rule, it will be found by far more efficient than would be most imported *matériel*"—(Colonel Haly).

All carts and wagons for use in the East, where the animals, as a rule, are much smaller in size than at home, should be of a light description.

The adoption of one pattern carriage for all services, which has been advocated by some writers abroad, is impossible, if for no other reason, simply on account of the variety of uses carriages have to be put to. One of the arguments adduced in favour of this measure was the supposed advantage of being able to utilise the empty carriages of every branch of the service for any purpose, to meet a sudden emergency; but the transfer of transport carriages from one branch of the service to another in the field would be attended with considerable inconvenience, and besides giving rise to confusion, would tend always to disorganize for a longer or shorter period that portion of the army which has been deprived of its transport, for no arm or branch of the service can be considered thoroughly efficient in the field that is not furnished at all times with sufficient transport means for all its equipment and requirements.

For military transport what are principally required are light car-

riages, and that the animals may be able to draw the greatest amount of useful weight without any of their drawing power being sacrificed to an excess of weight in the carriage itself. The system of having a rider for each pair of horses is a waste of power in transport, where the horses are neither required to go at the pace artillery move at, nor to pass over every description of ground at speed. Driving postillion fashion gives no doubt great command over the horses, and may be useful in getting through crowded thoroughfares, or applicable for ambulance wagons having to move over rough ground about the battle-field, but is open to serious objections. The rear horses, having to bear the weight of the rider, cannot draw much, and their tight girthing is not compatible with exertion, particularly if prolonged over bad or hilly roads. The riders are more fatigued than if driving, and are therefore more unfitted to bestow proper care on their animals at the conclusion of the day's journey; the drivers must be very expert to get the same amount of work from both horses, and require much longer training. Civilian drivers, being unaccustomed to this system of driving, would not be able to replace the military drivers if needed. This style of driving, with postillions is never met with in the ordinary transport of any country, why should it be retained in the transport of an army where more economy of power is needed?

Though the adoption of a special transport carriage to suit every country alike is entirely out of the question, still a light carriage, not more than 12 cwt. in weight, with a driver and pair of horses or mules, would answer admirably for service in most countries. The heavy four-horse wagons with riders might be replaced with advantage and economy by a two-horse carriage of this kind, from which would result the reduction of a pair of horses, and one man per wagon. Let us take one of the four-horse general service wagons detailed for a double company of infantry. In the "Regimental Transport Manual" we find the weight of the articles to be carried to be for every two companies of infantry 28 cwt. and 3 qrs., or 3,220 lbs.; add to this the weight of the general service wagon, a trifle under 18 cwt., and we obtain 5,236 lbs. as the total weight drawn by the four horses. A very considerable weight, be it remarked, to draw on often anything but the very best roads. At the Dartmoor manoeuvres in 1873, where the bye or secondary roads, used in ordinary times by farm wagons, were very much better than what would often be found in most countries in which we have to operate, the difficulty of drawing the heavy general service wagons up to the encampments in the wet days was very great; the draught animals were not equal to it, and numbers of extra horses had to be attached to each wagon; even then it took a long time to drag them over distances often of a few hundred yards only, whilst the heavy weight of the wagons cut up the roads very considerably. Sir G. Wolseley in his "Pocket Book," gives the load carried in the two-horse wagons used in the Red River Expedition over very bad roads as varying from 1,600 to 1,900 lbs.; two such wagons would carry as much, or more, than the general service wagon, would be more suitable for use on bad roads, and would be more handy if the companies were detached.

The weight of the model four horse or mule wagon for army purposes adopted for use in the United States Army is 1,325 lbs. In the last Afghan War pony carts were used in the Khyber line, these are alluded to thus, in one of Sir F. Roberts reports:—"These vehicles, which may be described as a combination of the ekka and the Maltese cart, are strong, yet light, and will be of great assistance."

The French Army in Mexico adopted largely of the American army wagon, drawn by six mules and driven by a single driver riding on the

(M.T.)

near wheeler. To provide against casualties, a spare driver was entertained for each two wagons, thus three men looked after twelve animals. The number of men would still have been insufficient had not the Mexican plan of looking after the animals been adopted. This consists in turning the animals loose into a *corral* or enclosure, or if in transit, by enclosing a piece of ground with the wagons.* The head-stalls are always kept on to lay hold of the animals easily: light portable mangers are carried for the purpose of giving the animals their corn, and when watering is to be done, a mule with a bell tied round his neck precedes the whole, who follow without straggling.

The Quartermaster-General of the United States Army, in his report furnished at the conclusion of the Secession War, stated that the carriages, harness, and altogether the transport *materiel* of the United States Army, were hardly susceptible of any further improvement. The French purchased some of the American army wagons for their transport during the Mexican War, and admitted their entire satisfaction with regard to them. In both countries the roads were often very bad, still this wagon, though charged with a heavy load, answered admirably.* A later testimony in their favour has been added by officers of our service who have seen it employed during the Zulu War.

We borrow from Messrs. Obauer and Guttenberg, Austrian Staff Officers, the following paragraphs to show what steps have been taken in the Austrian Army to reduce the length of the train, and to remedy the difficulty of turning the carriages round in narrow roads:—

"In these latter times (1871), endeavours have been made in the Austrian Army to reduce as much as possible the number of carriages. One of the steps taken with this object has been to alter the four-horse draught of the old provision wagons into a draught of three horses abreast, which has not only resulted in the economy of one-fourth in the number of animals, and the amount of forage to provide, but also reduces the length of the train columns by six paces per carriage. Lastly, the driving with long reins has been adopted.

"A second measure has been since 1867, the introduction of a new transport carriage capable of being drawn equally from the front or rear, so that if required hurriedly to retire, it is not necessary to turn the carriage, which is, moreover, often impossible in narrow roads, it is enough to transfer the horses and pole to the opposite end, that is to say, to change the side of the draught. More and above, this new carriage possesses the great advantage of being capable of being entirely taken to pieces."

Four or six-horse or mule wagons require considerable breadth of road to turn in, which is not always to be found, hence the adoption of the above device in the Austrian service.

If the power of draught is greater the nearer the animals are to the load they have to draw, the arrangement of these three horses abreast has its advantages, and any measures that will tend to reduce the length of a convoy of carriages cannot but be considered as a material improvement in transport. This system of harnessing three horses

* Placing large numbers of animals loose in a *corral* might lead to a loss of time in getting together the animals belonging to a team at each start; it would appear preferable to fasten them up in sets.

† In the American army wagon, the wagon brake was one of the great improvements introduced during the Secession War. It was found to answer better than locking with the drag-chain. The wagon brake saves time at the top of every hill to lock the wheels, and again at the bottom to unlock them, the check one wagon, halting for this purpose would communicate to the whole train is thus avoided. The best brake was found to be one which fastens with a lever chain to the brake-bar.

abreast is, however, applicable only to broad roads. which are not to be found in all countries alike.

The Maltese cart has been found very well adapted for service with an army in the field.* It weighs between 4 and 5 cwt., and is easily packed on board ship; as the draught animals, horses or mules, can be seized or requisitioned on landing, if a number of these carts, with a corresponding quantity of harness are put on board with the troops, they will be soon got ready for use after arrival at the port of debarkation.

In very dry weather, and when exposed to scorching heat, carts will break down in large numbers, and will become unfit for use, some spare ones therefore should be kept near at hand.

Wheel transport requires a good expert body of drivers, men who, besides driving, also understand the proper care and management of animals: with our establishments kept so low in peace time to find plenty of them on the sudden outbreak of a war will not be an easy matter.

Whilst still on the subject of wheel transport, let us advocate the use of poles in place of shafts for transport purposes, principally on the same grounds on which we have advocated the employment of drivers in place of riders. Shafts are no doubt better for carriages moving at speed, for rapid manœuvring, turning, etc., but they are undesirable where these points are of no object, for they throw all the weight of the wagon on the shaft horse when going down hill, passing over obstructions, or backing, thus the work is not as equally divided as it is when the pole is used. Poles have the further advantages over shafts that spare poles are more easily carried, if broken, are more easily repaired, and should a horse fall with a pole, he is more easily got up again.

With respect to harness, the Quartermaster general officers of the United States army recommend that the stitching should be reinforced with copper rivets, as in the dry atmosphere of the plains and adjacent country thread has been found soon to rot. This specially applies to collars, which, when the thread once gives way and the seam begins to rip, are ~~almost~~ irreparable without re-covering. In the United States service there is a well drawn up book of specifications and drawings for wagon harness for horses and mules, prepared in the Quartermaster's Department in 1877. The specification with regard to the quality and make of their harness is expressed in the following words: "The whole to be made of the best materials (oak-tanned leather); sewing to be done with good waxed thread; and in addition the quilters, belly bands, choke straps, back bands, crupper and hip straps, chain pipes and neck straps to have one No. 9 copper rivet and burr between each two rows of stitching; all buckles used to be japanned, malleable, barrel-pattern. The whole to be subject to inspection during process of manufacture, and also when finished."

Keeping a large quantity of harness in store is deprecated on account of the liability of its deteriorating, and the expense of oiling and rubbing for a number of years it entails, still a large supply demands such a very considerable time to prepare that we are compelled, as a matter of precaution, to keep a certain quantity in store, as a reserve in case of emergency.

Every division of wagons, carts, etc., should on service be provided with a certain number of breast straps, in addition to the regular harness, for horses or mules that have been rubbed by the collar or chafed on the flanks by the traces. Such a provision will permit of these

* A bar of wood down the centre will strengthen considerably the cross bars of the platform which are liable to break. The rope traces are liable to stretch unevenly, and, as animals do not pull well with traces of uneven length, this point should be attended to.

animals being worked whilst their wounds are healing. Breast straps, though lighter, cooler, more easily adjusted and put on, are, however, not as good as the collar for draught animals, for, where in the last, the animal feels the weight only in front of his shoulders, in the first, the chest is compressed, the shoulders are forced inwards, and much of the animal's power is neutralized by the weight pressing both in front and on the sides. Animals accustomed to this style of harnessing do not, however, take to the collar readily. In every case the collars must be separately and carefully fitted to each animal before the actual work of drawing begins.

Whatever description of transport is used, be it pack or wheel, a reserve or percentage of spare animals should always be allowed, for continuous work and exposure will affect the health of the animals as well as that of the men, besides, even with the greatest care, a number of animals will be unfit for work, laid up with sore backs, lameness, galls, etc. After continuous heavy work animals require a rest, and, where a number of spare animals are provided, some can be kept in the stables each day; those showing signs of giving way should be allowed a more prolonged rest to enable them to recover their strength.

A large train demands good roads and fair weather, for even good roads in bad weather will soon be made impassible for heavy traffic.

Wheel transport and good roads go together, for it is impossible to move even the best organized transport in an orderly formation on bad roads; the delays and stoppages will be very frequent, the carts will not be able to close up, and the column will extend an undue length, making, particularly if the enemy be enterprising, the defence of a convoy a serious and difficult matter. Bad roads double the fatigue the animals will have to endure, and will destroy many of them in a short space of time. Even whilst the transport is working on inferior roads much can be done to improve them by utilizing the labour of the country, and, as good communications are necessary to secure the efficiency of the transport, this important point should not be neglected. Where the roads are very bad, a few ~~of the~~ ^{of the} ~~introduction~~ ^{of the} ~~to~~ ^{of the} ~~each~~ ^{of the} ~~division~~ ^{of the} ~~of the~~ ^{of the} ~~train~~ ^{of the} ~~or to a~~ ^{of the} ~~convoy~~ ^{of the} ~~equally~~ ^{of the} ~~from the~~ ^{of the} ~~places~~ ^{of the}; their assistance would prove invaluable ^{to} ~~is~~ ^{to} ~~spare~~ ^{to} ~~animals~~ ^{to} ~~in these~~ ^{to} ~~cases~~ ^{to} ~~should~~ ^{to} ~~be used~~ ^{to} ~~to help~~ ^{to} ~~forward~~ ^{to} ~~the~~ ^{to} ~~wagons~~ ^{to} ~~over~~ ^{to} ~~difficult~~ ^{to} ~~places,~~ ^{to} ~~to~~ ^{to} ~~assist~~ ^{to} ~~the~~ ^{to} ~~efforts~~ ^{to} ~~of the~~ ^{to} ~~other~~ ^{to} ~~animals,~~ ^{to} ~~or to~~ ^{to} ~~replace~~ ^{to} ~~any~~ ^{to} ~~unfit~~ ^{to} ~~for~~ ^{to} ~~further~~ ^{to} ~~exertion.~~ ^{to}

It is a serious error to demand too much from transport animals at the commencement of an expedition. At first the marches should be moderately short, and not very fatiguing, increasing progressively so as to harden the animals by degrees to their work.

With every convoy or large section of the transport, provisions should be made for a few artificers with spare poles, axles, lynch-pins, ropes, traces, etc., to replace any articles damaged in transit. Lanterns or torches by the light of which to execute necessary repairs, or adjust loads at night should be provided. A supply of wheel grease for carts and wagons will be needed. Traces and splinter bars to put on additional draught when necessary in difficult parts of the roads, or to help wagons out of a difficulty, should not be neglected.

Though occasion may occur in wild countries where all these needs cannot be obtained, still if the transport officer knows what should be done to secure the best advantages for his train, he will improvise some of these means which, rough as they may be, will be better than nothing.

An officer of the 2nd Regiment of Zouaves, writing with regard to the transport train in Mexico, in 1864, says:

"The convoy of carriages which Douai's division brought from

Arroyozarco to Celaya was well organized. The carriages were grouped by fifteen under the orders of the same superintendent; behind this group came the led animals to replace the exhausted ones.

"Behind each group of 60 carriages was a light cart conveying spare articles, traces, harness, axles, poles, and some horse shoes. A smith with his tools moved with it prepared to execute repairs on the spot.

"The superintendents and their assistants were all mounted: they halted in difficult places to stimulate the animals with voice and whip and to direct them.

"On reaching camp, the carriages were drawn up in circles, ropes being stretched from one carriage to the other. The animals were confined in the interior of this circle, and eat together out of a canvas manger supported on legs in the form of an X."

The employment of traction engines for transport purposes has been recommended, still traction engines require good roads with solid foundations and such are not often found in our wars. Tortuous roads or others with sharp turns are also ill-suited for traction engines drawing a number of wagons. However, where suitable roads exist, and plenty of fuel is to be found, there is no reason why we should deny ourselves the aid of this powerful auxiliary on the line of communications. If even only used in suitable parts of the road, they will set free a certain quantity of transport for other purposes.*

A great fault in all military transport is that too little attention is paid to the animals, particularly pack ones, being fairly loaded. Sir C. Napier fought hard against this evil in Scinde; he divided his camels into two classes, strong and weak, and assigned to the first a load of 300 lbs., and to the second of 200 lbs., which he considered a fair weight for these animals in the country where he was operating. Each camel had a wooden label tied round his neck showing the weight of load he had to carry.

In the instructions for the management of camels, issued by the Deputy Quartermaster-General at Quetta on the 1st July, 1841, we find the weight for camels ^{for} w. 320 lbs., if carrying grain bags as carried with great ^{most irreparable} and baggage. ^{80 lbs. for ordnance, general stores}

In the late ^{are} ^{is a well drawn} ^{Abbott's} journal, from the year 1838 to 1842, with regard to the camels with the army of the Indus, the following passage occurs: "The baggage camels were generally overloaded, and this was the main cause of the loss by the army. An officer of the 2nd Cavalry told me he had seen 14 maunds (1,120 lbs.) taken from the back of a camel, the maximum load allowed by regulation being five maunds only." It should be noted that the average weight of a camel is 10 cwt., and we cannot see how a camel could rise with such a load upon him, which just equals that of his own weight. Further on General Abbott, speaking of the artillery, says: "Spare camels at the rate of one to four in use, were taken from Delhi, and not an article of baggage was abandoned by the artillerymen until they reached Candahar."

When on the subject of carriers it has been remarked that loads should be made up of uniform weights to facilitate the loading, this should apply to all military stores, particularly where pack transport is used. Sir C. Napier went as far as to recommend even the establishment of a regulation box, bed, table, chair, and other articles carried by officers and soldiers.

The following table showing how supplies are generally sent to an army in the field is borrowed from the soldier's pocket book, but it is pos-

* We tried traction engines in the Gold Coast, and soon gave them up. The Russians in 1879 used them to move stores from Chikislar, but with little effect.

sible for the supply department to alter the weight of the packages to suit the style of transport employed, though to do this it should receive early notice of the description likely to be used.

Food is generally sent to an army in the field in the following packages :—

Nature of Ration.	How Packed.	Size of packages in feet and inches.	Cubic measurement for freight in cubic feet.	Average weight in	
				Gross.	Net.
Biscuits ..	Bags	2' 6" x 1' 8' 36" ..	5	102	100
" ..	Barrels	2' 8" x 2' 2" ..	7-214	106	84
Salt beef ..	Tierces.. ..	2' 4" x 1' 11" ..	12-5185	530	300
" ..	Barrels	1' 7" x 2' 0" ..	8-5138	360	200
" ..	Small casks ..	(Same as salt beef.)	6-336	202	100
Salt pork ..	And in barrels	2' 5' 5" x 1' 9' 3" ..	7-745	325	200
" ..	Half	1' 11" x 1' 6" ..	4-3	190	100
" ..	Barrels	2' 6" x 1' 8' 36" ..	7-214	219	196
Flour ..	Half	2' 0" x 1' 4' 545" ..	3-8	113	98
" ..	Barrels	2' 8" x 2' 2" ..	12-5185	460	390
Sugar.. ..	Half	2' 4" x 1' 11" ..	8-5138	339	280
" ..	Kilderkins ..	2' 3" x 1' 8" ..	6-25	228	180
" ..	Small casks ..	2' 0" x 1' 7" ..	5	140	110
" ..	Barrels	2' 1" x 1' 6' 45" ..	4-93	127	102
" ..	"	1' 11" x 1' 4' 227" ..	3-49	94	79
Raw coffee ..	"	2' 8" x 2' 2" ..	12-5185	334	280
Ground „	{ In cases made up of 20lbs. packages	{ 3' 11" x 1' 4" x 0' 11"	3-7685	133	100
" ..	Small cases ..	2' 2' 5" x 1' 4" x 0' 8' 5"	2	73	50
Rice ..	Barrels	2' 8" x 2' 2" ..	12-5185	411	340
" ..	Half hogsheads	2' 4" x 1' 11" ..	8-5138	309	250
" ..	Kilderkins ..	2' 3" x 1' 8" ..	6-25	218	170
" ..	Small casks ..	2' 0" x 1' 7" ..	5	130	100
" ..	"	1' 7" x 1' 3" ..	2-473	67	50
Rum ..	9½ gallon cask	2' 3" x 1' 3" ..	3-515	119	89
Tea ..	Chests	1' 11" x 1' 9" x 1' 6"	5	{ 112 to 136	{ 90 to 110
" ..	Half chests ..	1' 10" x 1' 5" x 1' 2"	3	66	{ 45 to 50
" ..	Catties.. ..	1' 3" x 1' 0" x 0' 11"	1-145	28	21
Pepper	{ Cases holding 20lb. canisters	{ 3' 11" x 1' 4" x 0' 11"	3-7685	133	100
" ..	Small cases ..	1' 7" x 1' 3" x 1' 0"	2	73	50
Salt ..	Bags	"	3-3	202	200
" ..	Kegs	1' 6" x 1' 4' 227" ..	2-7	115	110
Preserved potatoes	{ Cases	{ 1' 9" x 1' 4" x 0' 11"	2-1388	79	56
Lime juice ..	Cases, 20 pints	1' 7" x 1' 3" x 1' 0"	1-979	69	..

The transport train of an army is such a hindrance to its rapidity of movement that it is necessary that each animal should carry or draw as much as he is fit to; in fixing the maximum of loads, however, due regard should be paid to the power of the animal to stand a continuous length of exertion. Overloading still is the rule, and not the exception, and as it is apt to cause serious injury to the animals, leading to their eventually breaking down, which will greatly delay an army, it requires to be carefully guarded against by all ranks alike.

Commanding officers and Heads of Departments must give their

personal attention to this very important point; but, besides them, the officers principally interested in this are the Transport Officers, whose duty it is to look after the health of their cattle, and the Baggage Masters whose business it is to see to the regularity of the march, and to guard against every chance of a break-down.

The appointment of one or more inspectors on this head might tend to reduce the evil, the inspectors being especially appointed to detect and inquire into any infringement in the scale of loads sanctioned by the regulations for all animals and wagons. A further precaution will be keeping a reserve of animals to replace those which, with the best precautions, and under the most favourable circumstances, will become unfit for work through sickness or accidents. Exertions in war are often of imperative necessity, and, though the advantages obtained by these are very considerable, still it should be remembered that they are never obtained without a corresponding loss both in men and in animals.

With regard to carts and wagons it is desirable to ascertain the weight of load of the several kinds used, as well as the length each occupies on the line of march. The power of draught of transport horses on good ordinary roads is calculated at about 9 to 10 cwt. per horse. Over mountainous or heavy roads, 12 cwt. (including the weight of the carriage) is about a full load for a pair of horses. In our service 800 lbs. is considered a good average load for a two-horse wagon, 1,800 lbs. for a four horse one, and 3,300 lbs. of one of the new general service wagons, drawn by six horses. General Sherman reckons the net load of a six mule American army wagon at 3,000 lbs., which will be seen to approach very close to the load of our general service wagon. He says "An ordinary army wagon drawn by six mules may be counted on to carry 3,000 lbs. net, equal to the food of a full regiment for one day; by driving along beef cattle, a commissary may safely count the contents of one wagon as sufficient for two days food for a regiment of 1,000 men." Colonel Hazenkampf, Chief of the Staff of the Russian Guard Corps, in an able work on the supply of an army in time of war, estimates the load for a cart drawn by a pair of horses at half a ton, and states that 350 pair-horse carts is the largest manageable section of transport. According to his calculations this number of carts will carry ten days supply for 14,000 men with 3,500 horses, about the strength of an infantry division with artillery park and field hospital. A single cart with a load of half a ton, according to his calculations, should carry ten days supply for 40 men or for 10 horses.

Wagons drawn by four mules are good for a load of 2,240 lbs., with two mules of 850 lbs., and the Maltese cart drawn by one mule can carry a load of from 450 to 500 lbs. The average amount carried in a cart with two bullocks is 850 lbs.; in one with four bullocks about 1,600 lbs.

Including an interval of 4 yards between each two wagons, in column of route, a two-horse wagon will occupy 12 yards, a four-horse one 16 yards, a six-horse one 20 yards.

A fair average load for Donkeys is	..	100 lbs.
" " Pack bullocks is	..	160 "
" " Horses and mules is	200 "	
" " Camels is	..	from 320 to 400 lbs.
" " Elephants is	..	800 to 1,200 lbs.

A pack-horse or mule, with interval between each two animals, occupies in column of route 4 yards, a camel 6 yards.

In preparing requisitions for the equipment necessary for a transport

train, a sufficient number of good tarpaulins to cover the country carts and pack loads of the auxiliary transport should not be omitted; without this precaution, a large quantity of provisions, both in transit and in camp, would run the risk of being spoilt. The sizes of these should be as follows: for carts, 10 by 9 feet; for horses, mules, and bullocks, 7 by 6 feet; for camels, 8 by 6 feet; for elephants, 12 by 10 feet. In warm countries these tarpaulins require to be made of such materials as will not stick together, for this purpose it is recommended to make them simply waterproof with boiled linseed.

The following was adduced in favour of tarpaulins in the evidence given before the Transport and Supply Committee of 1865: "A waterproof tarpaulin is lighter and more efficient than a solid cover; catches the wind less, fits tighter to the goods, and would be useful in camp as cover on floors for stalls." Tarpaulins are also required for water carriage, boats, barges, etc., and for the protection of the stores when stacked in the open.

Transport bringing up supplies from the rear should not be detained a moment longer than is actually necessary, and should be at liberty to return the moment the supplies have been delivered.

CHAPTER V.

TRANSPORT BY RAIL.

RAILWAYS; THEIR VALUE FOR MILITARY PURPOSES—LARGE BODIES OF TROOPS CONVEYED—REQUIRE CAREFUL WATCHING—THEIR VALUE IN THE ATLANTA CAMPAIGN—AFFORD RAPID MEANS FOR THE CONCENTRATION AND THE SUPPLY OF AN ARMY IN THE FIELD—WITHDRAWAL OF ROLLING STOCK PARALYSES THEIR USE—PRESENT NO REAL ADVANTAGE WHERE DISTANCES ARE SHORT—CONCENTRATION OF AN ARMY BY RAIL—NECESSITY FOR A MILITARY RAILWAY CORPS—DIVISION OF WORK BETWEEN THE RAILWAY AND MILITARY STAFF—STOPPAGE OF GENERAL TRAFFIC—RAILWAY STATION COMMANDANTS—PLATFORM ACCOMMODATION—END AND SIDE LOADING—SIDINGS—TIME AND MEANS REQUIRED FOR UNLOADING—NUMBER OF TRAINS THAT CAN BE DESPATCHED EACH DAY—SPEED—DOUBLE AND SINGLE LINES—RETURN OF ROLLING STOCK—TROOPS TO BE PRACTISED IN RAILWAY MOVEMENTS—ENTRAINING OF THE VARIOUS ARMS—DETRAINING—WORKING LINES IN THE ENEMY'S TERRITORY—RECONNOITRING A RAILWAY LINE—GUARDING AND DEFENDING—DESTRUCTION—TIME TABLES—PIONEER RAILWAYS.

In regular warfare railways are so essential for the concentration of an army, and so intimately connected with the line of communications service, that a thorough knowledge of all the advantages that can be drawn from their employment in aid of an army in the field is imperative. The Germans are so entirely alive to the importance of officers becoming acquainted with railway work that in the *Duties of the General Staff*, by Von Schellendorf, we find the following passage: "In consequence of the large number of general staff officers required to carry out the concentration of a large army by rail, endeavours are now being made to attach all general staff officers for a time to the railway section, to make them familiar with the duties."

As nothing is so essential in war as good communications and rapid means for supplying the troops with all that they require during a campaign, improved locomotion by steam, both with regard to land and water carriage, has rendered immense services to modern armies. Of

all the applications of the scientific discoveries of the present age for war, none have had a greater influence on the movements of troops and their maintenance in the field, than railways. These will now form the main portion of the military transport in most civilized countries, as all the principal towns are connected together by railroads, whilst new lines are being continually constructed. Wheel and pack transport, carriers, ships and barges, will have, however, to work in conjunction with them, bringing supplies and *matériel* to the various loading stations, or removing them from the regular or temporary terminus of each line to the various magazines or else distributing them amongst the several fractions of an army.

The value of railways increases every day, as the experience in their working augments, and the system progresses towards perfection. To obtain all the advantages which they are capable of yielding in a military point of view a thorough study of everything connected with them is necessary. The Germans have a railway section of the head-quarter staff, of which Von Schellendorf says: "Its special duty is to attentively follow everything that affects the subject of military transport, and possess an accurate knowledge of all railway systems both at home and abroad, together with the amount of traffic they are capable of, and work out large military transport arrangements, &c." When railway lines affected to the ordinary traffic pass suddenly to transport large bodies of troops, with their horses, carriages, equipment, stores, supplies, &c., the change from the usual daily routine of work will introduce of itself some elements of confusion. It may be said that this confusion will wear itself off with the novelty of the thing, but if proper measures are taken beforehand, and every point has been accorded due consideration, we may expect to overcome all fear of confusion from the very first, particularly as we have the aid of military discipline during the movement which is wanting in the ordinary daily traffic.

On railways being first laid down in Europe,* it had not been foreseen of what value they would eventually become in a military point of view. Europe had then been at peace for a great number of years, and the railway lines were laid down for purely commercial purposes; on this account their direction was principally dictated by topographical reasons, and by the position of the most fertile districts and large manufacturing towns, where the wealth of a country generally lies; the rolling stock was simply constructed according to the most approved designs of the day for conveying passengers, stores, and merchandize of all sorts. The employment of railways for military purposes has been very gradual, their first use for the conveyance of a large body of troops only dates as far back as 1849, when a body of 30,000 Russian troops, then quartered in Poland, were moved by rail to join the Austrian Army in the Hungarian war. In the campaign in Italy of 1859, the French moved 115,000 men, 25,00 horses, and a large number of carriages, ammunition, &c., by rail, while the Austrians on their side poured large reinforcements by the same means into Lombardy. The War of Secession in America is full of examples of movements of troops by rail, the most important being the transport of the XIth and XIIth corps, General Hooker's, of 23,000 men, fully equipped with horses, artillery, and transport in 1863, from the East to Chattanooga, over a distance of 1,192 miles in 7 days.† The war of 1866 in Silesia again showed the great use that railways afford in conveying large bodies

* The first railway train started on the 14th September, 1830, running between Liverpool and Manchester, a distance of 55 miles. The rate of speed was about 20 miles per hour.

† Report of the Secretary of War (Mr. Staunton), dated November 22, 1865.

of troops to the frontier, but by far the largest movement by rail yet on record has been the concentration of the German army previous to the crossing of the French frontier in 1870. This concentration was mainly carried out by six principal railways; 1,205 trains conveyed in about 15 days to the frontier:—

456,000 officers and men.

135,000 horses.

14,000 guns and carriages.

To draw all the advantages that can be expected from the use of railways in war, experience has now fully shown that, first, strategical considerations must determine the most desirable direction to be followed in laying down the various lines of a State; secondly, that the rolling-stock in future must be constructed in such a way that, whilst answering all purposes of commerce, still may possess all the requisites necessary for the conveyance of men, horses, and military carriages.

Railways are artificial roads very costly to construct and maintain, easily destroyed or put for a longer or shorter period out of working order by local destructions or obstructions, which may be not only caused by the operations of an enemy or the disaffection of the inhabitants of the country through which they run, but also by floods, storms, continuous heavy falls of snow, faulty construction, and carelessness or neglect of the men employed on them: other causes, such as want of fuel, water, insufficient rolling-stock, or *personnel*, will likewise limit their action. When a railway line passes through a fortress which is in the enemy's hands, the through working of the same must cease pending the reduction of the fortress. Thus, for example, in 1870, the fortress of Toul denied to the Germans, till the fall of the place on the 23rd of September, a continuous employment of the only line they could use for their armies before Paris. True enough that a work was put in hand at once to avoid the obstacle by a circuitous route, but this was not completed before the capitulation of the place. A fortified place *à cheval* on a railway line, when in the hands of the enemy, will always cause a break in the system of transport, demanding a large park of carriages to convey stores, &c., between the two ends of the line in actual possession.

A local obstruction will cause a loss of time, not so much from having to convey stores, &c., over the distance where the railway traffic is interrupted at a slower rate of speed, as on account of the time required to discharge the stores into carts at one end, and shift them again into wagons at the other. Take, for example, a provision train, generally composed of from 25 to 30 wagons, giving 7 tons as the average weight of load of each wagon, we find that from 175 to 210 tons will be conveyed in the train, requiring a park of from 219 to 263 two-horse carts, capable of carrying a load of 16 cwt. each. The work of shifting the stores on to these carts and back again into railway wagons demands a considerable time. It demands, besides, a large body of carriers or porters, and a good deal of supervision so as to avoid any unnecessary loss of time, for the point to keep in view is to clear the unloading station as rapidly as possible, to allow of a fresh train to come in and discharge in its turn.

In war, railways are most useful, but, owing to their easy destruction, are very precarious lines of communication, and a large force is needed for their protection to be able to profit by all the advantages they offer as such lines. They require careful watching over their entire length, and should be used in conjunction with the ordinary roads of a country; as they follow the direction of the commercial routes of

each country it will be easy to employ the two in conjunction, so that the latter may take the place of the former when any temporary obstruction occurs.

Railways can be regarded as one of the artificial means for accelerating a march, for troops can be forwarded over long distances about four times as fast by railway as by ordinary marches; the use of railways reduces, moreover, the enormous transport trains which formerly used to follow an army, and with them the loss and damage of supplies in transit. The numerous carts and pack animals requiring a number of men to attend on them, and encumbering the roads for days, will now in great part disappear, as the railways will undertake the principal part of the transport of all supplies required by an army, thus materially reducing its cost and permitting of certain otherwise impossible operations to be carried out.

"The value of railways" (says General Sherman) "is also fully recognized in war quite as much as, if not more so, than in peace. The Atlanta campaign would simply have been impossible without the use of the railroads from Louisville to Nashville, 185 miles, from Nashville to Chattanooga, 151 miles, and from Chattanooga to Atlanta, 137 miles. Every mile of this 'single track' was so delicate, that one man could in a minute have broken or moved a rail, but our trains usually carried along the tools and means to repair such a break. For the protection of a bridge, one or two log block-houses, two stories high, with a piece of ordnance and a small infantry guard, usually sufficed. The block-house had a small parapet and ditch about it, and the roof was made shot-proof by earth piled on. These points could usually be reached only by a dash of the enemy's cavalry, and many of these block houses successfully resisted serious attacks by both cavalry and artillery. The only block-house that was actually captured on the main was the one described near Allatona.

"Our trains from Nashville forward were operated under military rules, and ran about ten miles an hour in gangs of four trains of ten cars each. Four such groups of trains daily made 160 cars, of 10 tons each, carrying 1,600 tons, which exceeded the absolute necessity of the army, and allowed for accidents that were common and inevitable. But, as I have recorded, that single stem of railroad, of 473 miles long, supplied an army of 100,000 men and 35,000 animals for the period of 196 days, viz., from May 1 to November 12, 1864. To have delivered regularly that amount of food and forage by ordinary wagons would have required 36,800 wagons of 6 mules each, allowing each wagon to have hauled 2 tons 20 miles each day, a simple impossibility in roads such as then existed in that region of the country, therefore, I reiterate that the Atlanta campaign was an impossibility without these railroads, and only then, because we had the men and the means to maintain and defend them, in addition to what was necessary to overcome the enemy."

Such are the incontestable advantages which a railway line presents to an army as a line of communications, that in future wars no commander will choose a line of operations that is not closely connected to a railway line. The study of the science of war will be directed to strengthen this line and to regulate the work to be performed on the same. As in every State the normal course of supplying large cities and moving the manufactures and resources of the country will depend more and more on railways, these will become more necessary to an army which must always follow in what is the general transport of a country.

The advantages which are obtained by the use of railways in war are, ease and rapidity in concentrating an army on a distant point,

providing it afterwards with all it requires during the course of the campaign, and freeing it of all that would hamper its movements.

The important assistance which railways offer to the military service demands in return that the strictest attention be paid to all the details connected with their working. Without the greatest order, regularity, and foresight, not only all the advantages they offer will not be obtained, but complications may ensue which it will be difficult, even if not impossible, to remedy. No railways can be worked without a great practical knowledge of all the conditions which regulate their power, for the technical rules by which they are governed are invariable and must be rigidly observed.

We were the first to lay down a railway line for purely military purposes. The short line from Balaclava to the front during the siege of Sebastopol was the first attempt, this was again repeated in the expedition to Abyssinia, where a line was laid from Zoula, the landing place in Annesley Bay, to Koomayleh, a distance of about 12 miles. We have not, however, carried out any warlike operations along a line of railway, hence we must fall back on the experience gained by foreign armies in the Italian campaign of 1859, in the War of Secession in America and principally in the German wars of 1866 and 1870-1871. From a careful study of the arrangements found necessary in these campaigns it will not be difficult to lay down some clear rules of action, which, in the event of our troops having to operate along a line of railway, will render the task comparatively easy; we must therefore examine the principal difficulties which will have to be encountered.

Two principal points that bear great results in the operations of an army in a campaign are facility for moving troops and ability to feed them: by the employment of railways both of these requirements are secured. The advantages railways present in placing large armies on a war footing by collecting men, materials, and supplies, and concentrating them, after mobilization, on a distant part of the frontier, are considerable. This was exemplified clearly in the Franco-German war of 1870-71, when the Germans concentrated from various distant quarters of the Empire an enormous army in the Bavarian Palatinate in the short space of 15 days, viz., from the 19th July to the 2nd August. The gain in time in commencing operations and the immense saving of wear and tear of life, which was caused by the long marches undertaken in former times to bring opposing armies face to face, are advantages beyond question.

From this it follows that a larger number of effectives than was the case formerly will be in the ranks at the commencement of a campaign, an advantage that carries with it the serious drawback that the troops do not become accustomed to camp life, and to the hardships of marching, before the actual hostilities commence, hence the first operations will cause a large diminution in the ranks. By the employment of railways the effective strength of an army can, however, be kept up during the course of a campaign much nearer to the established strength than was possible in former times;* this actually was the case during

* It has been ascertained by carefully compiled statistics in Prussia, and from experience based on many campaigns, that the loss of men in a year's campaign amounts to 40 per cent. of the infantry of the field army, 20 per cent. of the Cavalry, Artillery, and Engineers, and 12 per cent. of the Military Train. After the army has marched four weeks, the first reinforcement of men is forwarded from the depôts of regiments in the field. This consists of one-eighth of the above calculated yearly loss. On the first day of each succeeding month a fresh supply is forwarded, calculated at one-twelfth of the yearly loss. After a bloody battle, special reinforcements are sent. Colonel Fletcher, in his lecture on the "Disposition and Place of Reserves in Time of War," states that by a calculation made, it was found every 12 months' fighting required the replacement of 75 per cent. of the Service Army to keep its numbers up to the war strength.

the German operations in France in 1870-71; but in this case a continuous railway line run from the heart of Germany to the front of her armies, the territorial centres of the various army corps were thus in uninterrupted railway communication with their respective corps in the enemy's country. For recruits and young soldiers, however, the march is an excellent school, and therefore preferable to their being conveyed by rail, in all cases when time is of no object. The march hardens the recruits, who, on joining, appear of good physique, and this inspires confidence as to their quality.

Besides the great advantages we gain in the concentration, railways also provide the means for forwarding rapidly to the field army reinforcements of men, horses, ammunition, heavy siege guns, war *matériel* and supplies of all sorts. The removal of the sick and wounded, of prisoners, war trophies, and everything, in short, which, being of no use can only impede the rapid movements of an army, is a further advantage we derive from railways. In the way of troops sent to escort prisoners of war by rail, first of all the escorts need not be as large as when moving by the ordinary roads, secondly, the escorts can rejoin their respective corps in a very short space of time.

The collection of supplies from districts far removed from the seat of war, which is now possible with the improved means of locomotion, ameliorates the distress of the people of an invaded country, and enables the soldier to be better fed and kept in better discipline. The removal of the sick and wounded from the neighbourhood of the battle-field lightens the cares of a General, and gives confidence to the combatants, who know that but few of the horrors of the field hospitals await them, and that, if wounded, they will be well cared for. Their removal from the scene of strife will conduce more than anything else to secure them that quietness of mind always so essential for the complete recovery of sick people. In removing a large number of prisoners of war from the enemy's country, special attention should always be paid to their state of health, as insufficient food, overwork and want of rest, bad and tainted atmosphere, may have laid the germs of severe contagious diseases amongst them, which it will be undesirable to communicate to a healthy population. This precaution applies likewise to one's own sick and wounded, where they have contracted any contagious epidemic in the enemy's country.

Railways play a most important part before the commencement of hostilities in the concentration of troops. Of two armies, equal in every respect, the one which can first effect its concentration will gain important strategic advantages over the other. Our organization not being strictly territorial loses one important element, rapidity in concentration. We cannot say the first, second, or third army corps will effect its mobilization, and will be concentrated at such a point for embarkation, for the force to proceed abroad, being entirely composed of regular troops, must be taken from the cadres of several army corps, each of which is composed of regulars, militia, and yeomanry. The time required for conveying a force from the port of embarkation to a distant shore is also considerable, as we have to transport it in ships which have not the same rapid rate of movement as railways, and must go round many miles of coast, whereas railways go pretty direct from point to point. Our first concentration will be at the port of debarkation, leaving the country invaded from the coast to the frontier at the disposal of the enemy, whose concentration we can in no way hinder, and who will have time, after it is effected, to occupy the most important strategical points in the theatre of war.

With the recognized advantages of railways along a line of operations, and on account of the main lines leading to the capital and most

important towns of a country, the debarkation of our troops should take place, if possible, at a seaport town in which the terminus of a railway is situated. After the landing a concentration becomes necessary in the interior, somewhere away from the coast, safe from interruption from the enemy, always an indispensable condition in using railways in war for this purpose.

A most serious consideration, however, remains to be noticed in the case of an army of ours invading an enemy's country from the sea. The most complete way of denying to one's adversary all the advantages of railway lines is undoubtedly the removal of the rolling-stock. Thus the Austrians, previous to the battle of Custoza, withdrew all the rolling-stock of the Venetian lines under the walls of Verona and to Venice, and MacClellan destroyed his by precipitating it in a deep river, rather than let it fall into the enemy's hands. The Germans in 1870-71 found the want of sufficient rolling stock the greatest difficulty they had to contend with, the company of the *Chemins de Fer de l'Est* having removed to Paris and to the southern provinces the greater part of theirs. What was brought from the German lines, besides paralyzing the commerce of their own country, was ill adapted for use on the French railways, the carriages being larger and the locomotives longer and higher than the French ones. However, the German railway lines abutted on the French ones, hence the difficulty, with plenty of hands and materials from home, could be overcome; but with us, under similar circumstances, we should have to obtain all the rolling stock required from home, by sea, which would demand an immensity of transport and a very large staff of artificers to set it up. If no other drawback existed the time alone required to do this would be very considerable, and during this period the enemy could make use of the railways in his hands for all purposes, thus gaining immense advantages over us.

Naval transports and not railways must generally be the means for our first concentration. In India the case is different and there the railway lines present to us every day improved means for rapidly concentrating a force on any menaced part of the frontier or centre of a disturbed district. With regard to obtaining supplies, the command of the sea enables us to procure supplies from an unlimited number of places, extending from the countries close to the port of debarkation along the whole line of sea communication to our own coast. The further the port of debarkation is from home the more necessary and economical it will be to obtain the supplies required from the mercantile ports nearest to the seat of war. Agents should proceed for this purpose to the different markets, and to them the requirements of the army should from time to time be telegraphed. The port of debarkation or base would stand in the place of one's own country, the supplies forwarded from home, obtained from the adjacent ports, and those obtained in the occupied territory, going to subsist the troops.

For short distances with numerous forces no advantage with regard to time is ever gained in moving troops by rail, as the time required for putting the troops in the train, detraining them on arrival, and the interval of time necessary between the despatch of successive trains, will counteract most of the advantages gained by rapidity in transit. The value of railways for military movements, therefore, increases with the distance troops have to be conveyed over; in short distances, marching in several columns by different roads, the distance could be traversed in a shorter time than moving by rail. The campaign of 1870 offers a very good example of this. In the month of August of that year, Marshal Canrobert was commanding an army corps at the Camp of Chalons. After the first disasters which overtook the

French Army at the opening of the campaign, he was ordered to move his corps to Metz by rail. Accordingly, 31,115 men, with 2,296 horses and 255 carriages, were despatched to Metz by rail in 40 trains, the entrainment lasting from the 9th to the 13th. There being no direct line to Metz, the troops had to proceed by the circuitous way of Nancy and Frouard.* On the night between the 11th and 12th of August, the Germans occupied the line at Pont-a-Mousson and half of the trains could not continue the journey to Metz. Let us look, now, at the direct route from Chalons to Metz by Verdun; the distance is only what troops generally get over in four or five ordinary marches, with a railway for the first half of the way. By this route Marshal Canrobert, with the whole of his corps, could have been at Metz about the 13th, whereas his last trains were only leaving Chalons on that day. Before the commission of inquiry of the National Assembly, the Marshal stated as follows: "Unfortunately I had been called with my Army Corps too late. The Army Corps that had 20 batteries had only been able to take 9 to Metz; of 4 infantry divisions, 3 only were present; of 6 cavalry regiments, only one squadron had been able to come by rail. I had a considerable engineer park at Chalons, but only two companies of engineers had been able to arrive; 11 batteries of artillery, all the *mitrailleurs*, had remained at Chalons." Had his corps been very slow in reaching Metz by road, still it would have been in a position to take the German army in flank on the 16th, and would have disconcerted their plans considerably.

When there is no advantage to be gained in point of time by sending troops by rail, it will be better in every respect to keep them, and move them together in one body. With the best arrangements only a limited number of trains can be despatched each day, the troops for whom conveyance cannot be provided should commence the movement of concentration by marching. This will debarrass the railway terminus town of a number of troops and will accelerate the concentration, as the troops may be directed on some other station towards the point of concentration, where the return carriages will meet them. To prevent accidents this arrangement must be taken into account in preparing the time tables for the entire movement. Once the concentration of an army is completed, the use of railways, as far as it regards the transport of the troops, ceases, for in the vicinity of the enemy these must move in large compact masses.

In India the distances are so great that railways lend themselves very much for the transport of troops. However, troops in India have a large quantity of cumbersome camp equipment, and numerous transport animals and camp followers, and when the distances traversed are very long we must not lose sight of the fact that the transport of all this becomes very expensive, and takes up a large amount of rolling-stock. Still, as the rule is to forward the different units by rail complete in all they require, ready to take the field on getting out of the train, it will be found better to sacrifice money and rolling-stock than to make calls for camp equipage on the arsenals close to the point of concentration; in these there will be a very heavy pressure of work, and this should not be augmented, but relieved by sending the troops from the furthest off stations fully equipped. The collection of baggage animals demands plenty of time, and prices will rise when on a sudden a large quantity will have to be purchased, besides, baggage animals are required for other purposes than for the regimental transport, and it will be also the best plan to complete the troops with these before entraining.

* In this case the line Nancy-Metz was dangerous because parallel to the advance of the enemy.

In the German official account of the war of 1866, we read, "The transport of the troops was effected between the 16th May and the 5th June. The marches by road were so arranged as to be accomplished in the same time." The whole of the marches and the railway movements were so arranged by the General Staff in harmony with the railway department, that in their execution, in which both the military and civil powers were concerned, no impediments or delays could occur. "The result of these arrangements was that in the 21 days allowed, 197 000 men, 55,000 horses, 5,300 wagons were transported for distances varying between 120 to 300 miles without any failure, and in such a manner that they attained the required spots at the very hour requisite."

Regarding the concentration of separate corps before the concentrations of the army on the frontier, the official German account of this war expresses itself thus: "As a general rule such concentrations of large bodies of troops previous to their transport are not advisable. They practically make the future transports more difficult than if troops are marched direct from their garrisons to the suitable points of embarkation." The troops in their garrisons, however, are brought up to their war strength, and completed in every particular. Thus, in 1870^d, the Germans, in place of hurrying their troops to the frontier, organized them in their garrisons; during the first week after the declaration of war the railways principally conveyed the reserve men and those on leave back to their respective corps, the passenger and traffic services were only suppressed on the 24th July. On the 26th, the mobilization being completed, the transit to the frontier commenced, and was effected in thirteen days. Some of the Prussian corps had to traverse from 380 to 440 miles.

The rapidity of a concentration by rail depends on the judicious pre-arrangements made in peace time, when every point can be leisurely considered; on the quantity and capacity of the rolling-stock available; on the nature of the lines, whether single or double; on the interval considered necessary between the departure of successive trains; on the platform accommodation, either permanent or temporary; on the number of sidings; on the assistance in men and *matériel* to be obtained from railway lines not affected by the movement. Time is first required for the companies to make their arrangements, the more time given them the more perfect these will be. The course of events and the probability of certain political complications ending in war will of themselves cause some measures of preparations to be taken by a well-regulated and foreseeing company. On the extent of these will depend the interval required to complete the arrangements. The accumulation of the rolling-stock at one station requires a certain amount of time, for the various kinds of vehicles, even if not in use, are scattered all over the length of the line; these must be collected, grouped together, and brought up to the entraining station; the difficulty attending the collection of a very large number of vehicles of all descriptions should therefore not be overlooked.* Few companies have more rolling-stock than they require for the normal traffic in times of peace.

* The German official account of the war of 1866 lays down 8 to 10 days as necessary for companies to make their preparations for great exertions. In 1870 the order for mobilizing the German army was issued on the night of the 15th-16th July, the movement of concentration by rail did not commence before the 23rd July, 7 days later. Quoting from the same account we find, "The transport of an army corps with all its appurtenances (whether for long or short distances) requires from 9 to 12 days if all ordinary traffic is not suspended, and if a few trains of the intendants are allowed daily to pass along the line." Two corps moving in succession over the same line would cause a delay in the concentration of from 9 to 12 days.

Of the rolling stock a certain portion (about 10 per cent.) is always undergoing repairs, for, besides the regular wear and tear, accidents, sharp-curves, and in some countries great changes of temperature (where intense heat is followed by drenching rains), cause a considerable deterioration of the rolling-stock: another portion of it is in transit, loaded. The collection of suitable carriages, therefore, requires time and, as the commercial requirements are not identical with the military ones, part of the rolling-stock is often found unsuited for the use of troops. In India the famine of 1876-77 showed that the stock was insufficient for an emergency, and station-masters were charged with taking bribes for favouring out of their proper turn despatches of grain for companies and individuals. In that country the Chamber of Commerce petitioned Government for an increase in the rolling-stock which an emergency in peace time had shown to be insufficient.

In regular armies the proportion of the various arms varies so very slightly that it will not be a difficult matter to ascertain roughly the amount of rolling-stock required for the infantry, cavalry, artillery, engineers, transport, &c., of any given force. Often rolling-stock will have to be borrowed from other companies; to recognize this at any time, so as to be able to return it when no longer required, each carriage or wagon should bear a particular mark or the monogram of the company. In Germany each carriage, wagon, truck, &c., is also marked with what it is able to accommodate or convey in case of war.

The first labours of a railway staff, on a line being requisitioned for military movements, must be the disposal of merchandise in course of transit, either by taking it to its destination or unloading all the goods wagons, trucks, &c., standing in stations, after which no fresh goods trains should be loaded. The passenger trains must be gradually reduced to a very few, the principal running in conjunction with the postal service which it is desirable to maintain. The rolling-stock must be drawn close to the entraining station, all sidings being kept clear in case any military movement should suddenly ensue; telegraphists, signallers, porters, and railway workers must be largely increased at the principal stations, to work by relays; stations where troop trains are to halt require to be provided with water-butts, buckets, &c., with improved means of lighting and of accommodation; orders affecting the movement, time-tables, notices of precautionary measures to be observed, &c., have to be prepared and distributed.

In a concentration of troops by rail it is far better to concentrate, first, a complete division or corps than a portion of several ones. A complete division or corps can protect the concentration of the rest, and even disturb the concentration of the enemy; being a complete unit it can act with more effect than where fractions of various units are employed.

To the concentration of troops and to replacing the troops drawn from fortresses, and large garrisons for the field army, railways are devoted for the first days after a declaration of war. At this period the lines are entirely required for the troops, and a large despatch of supplies and *matériel* will be impossible, besides which it is desirable to keep the transport of troops and *matériel* distinct; once, however, the concentration is effected, their use as far as moving large bodies of troops (except reinforcements) in the direction of the enemy ceases, for in the vicinity of an enterprising enemy troops must move in large compact columns.* At this stage the lines pass under the direction of the

* Railways render greater aid to strategy than to tactics. In the "Spectateur Militaire" of 1868, is a translation from an Austrian document, where the writer goes to show that to make use of railways for any tactical operation it should be
(M.T.)

officer in charge of the line of communications as lines of supply, and under his superintendence are used to forward reinforcements of men and horses, provisions, ordnance stores, forage, clothing, treasure, and, in short, all that is necessary for an army in the field.

With regard to reinforcements railways enable an army to be largely augmented in the expectation of a battle. Examples are not wanting where troops have been sent by rail to reinforce an army expecting an engagement, or even to take part in one going on. Thus Conseil Dumesnil's division of the 7th French Corps was conveyed by rail from Colmar to Reishoffen to strengthen Marshal McMahon's line of battle previous to the Battle of Woerth. General Forey at Montebello, in the campaign of 1859, in Italy, brought reinforcements from the rear by rail and defeated the Austrians. These latter, during the battle of Magenta, received without interruption reinforcements by rail. At Bull Run, in the opening of the American War, a reinforcement of the Confederate army, conveyed by rail, was instrumental in deciding the day against the Federals. At the second battle of St. Quentin, General Faidherbe was compelled to retire, principally owing to the continuous arrival of fresh bodies of German troops conveyed by rail. In these cases the enemy had no power to obstruct the movement, the lines being protected by the troops already engaged, but the cavalry covering an army having now accepted the destruction of the enemy's railway lines as one of its duties, will in future make these movements impossible, particularly where the lines run parallel to the front of an army. A case in point happened at the very beginning of the Franco-German War when some German Lancers, by blowing up a viaduct on the railway which connected the various corps of the French army, destroyed their lateral communication and prevented reinforcements being sent by rail to the battle-field of Woerth.

In a concentration of troops the ordinary time tables must be replaced by new ones prepared purposely for the work: the preparation of military time tables demand a full knowledge of all the requirements for military movements on a large scale. In the arrangements for concentrating the Vth and VIth Prussian Corps in Silesia, in 1866, a joint commission, composed of a staff officer and a civilian, arranged the transport of both these corps.

When of two armies on the same theatre of war, one advances and the other retires, the latter will undoubtedly destroy the portion of a line of railway which it can no longer use and protect, so that there will be always a break between the front of an advancing army and the serviceable end of a railway in its rear. Means must therefore be provided to re-establish the line as soon as possible, and to bring it forward so close to the army as will enable it to derive as many as possible of the advantages that a railway offers to an army as a line of communication.

The regular working of a railway line in an enemy's country must

borne in mind that at the utmost 24 hours will be at one's disposal, in which time only 25,000 infantry, or at the utmost a strong division of the three arms, can be brought up by means of railways. A despatch of troops by rail to create a diversion, to forward reinforcements of fresh troops to a battle field, to put down a sudden rising, &c., can be carried out in a different way from a movement of concentration. Here the rapid despatch of a number of trains with the minimum interval of time is needed, the capacity of the carriages being made use of to the utmost. The distance to be run over is not likely to be considerable. There is no time to collect a large quantity of rolling-stock, and the troops must be forwarded, making the best use of the carriages which are available. In stations of importance, there will be generally rolling-stock sufficient for from 8 to 12 trains. Infantry will form the bulk of the troops, and this arm takes a very short time to get in and out of a train.

be entrusted to a staff drawn from the railway companies at home, for it is impossible for us to obtain a sufficient and efficient staff from any other source.

Military Railway Corps.

The employment of railways as lines of communication has necessitated the formation of a special military railway corps, whose services would be entirely connected with the working of the railway lines used by an army. The advantages of having a corps of this kind are many; the following amongst others are most important:—the men are disciplined and subject to absolute obedience; they are able to defend their own works; being armed they can be kept at work even in the vicinity of an enemy, which is either impossible when civil labour is employed or demands the protection of numerous guards; lastly, their training principally aims at their adapting themselves to circumstances and overcoming all difficulties.

The work of a military engineer on service is rough; with him rapidity of execution is a greater object than elegance, solidity, and finish. By his professional education a military engineer becomes acquainted with all the requirements of an army in the field, and his practical instruction is such as will enable him to make use of whatever means he can procure for himself, deciding quickly which amongst a variety of shifts is the most suitable for the particular case he has on hand. The civil engineer, trained in a different school, notwithstanding his knowledge and high proficiency, is less fitted for working under trying circumstances and in the vicinity of an enemy. The civil artificers he has to work with have not the habit of discipline, and do not possess that passive obedience which only military education imposes on all its people.

The railway corps has for its first duty to repair or destroy the road and works within the zone of active operations. In repairing their aim must be to make the road as soon as possible passable for a train, then proceeding further on to attend to their special work, leaving the task of consolidating and completing it to the civil staff in rear.

In time of war the repairs must be executed rapidly, and only what is considered of the utmost necessity for the moment must be attended to; what is of the greatest importance is to make the road fit for the safe transit of the trains, all the solidity which is required to make a line capable of withstanding a continuous traffic for years must therefore for the time be set aside.

The Royal Engineers have too much to do in their special branch to be able to devote their attention sufficiently to railway work. Their science is undergoing continual alterations, and demands constant study to obtain proficiency in it; being burdened, therefore, with railway work can only be prejudicial to their efficiency in their special employment. During the last few years the working of the field telegraph, of railways, and of torpedoes have been added to the duties that formerly appertained to this corps, whilst the introduction of long range heavy ordnance and breech-loading rifles have quite revolutionized the system of fortification in use. Thus the Royal Engineer Corps has been burdened with a multiplicity of studies which cannot but be prejudicial to their progressive instruction and to their efficiency in their legitimate work. The strength of the corps may be augmented to provide for this extra demand on its labours, but it remains to be seen if the instruction of any additional companies would be confined to any special branch, or if it would not extend to all the various branches alike. A special corps for railway work seems preferable, for it would certainly devote all

its attention and energy to this speciality, and this would lead to its members attaining a more perfect knowledge of the same than would be possible under the present arrangement. For this special branch officers and men should be trained in peace time; they should be thoroughly instructed in what would be required of them in time of war, viz., in all the works of constructing, repairing, destroying, and working of railway lines. Their tuition should be guided by a special code mainly applicable to the railway corps.

In Germany, "the railway battalion is intended to form in war the nucleus of the military railway formation, and, in addition, to train officers and men to military railway duties, and further the development of field railway technical knowledge." A railway battalion is divided into eight constructing and four working companies.* The first make impromptu lines, the second take them in hand as soon as made, man them with drivers, stokers, pointsmen, telegraphers, &c., and put them in working order. The service over one section, once well established, is handed over to the civil staff, the trained companies moving forward to complete a fresh section. The French recommend sections of about 300 men each on a war footing. Six of these sections formed into one or more battalions would give a sufficiently strong body to endow it with proper *matériel*, a proper instruction ground, and such others means as are necessary for the instruction of both officers and men.

The formation and training of a railway corps can only be carried out in time of peace. All impromptu organization is useless, particularly so when real practical training is required. The Director-General of Railways in America showed, in his report to Government, that the railway corps used with such success in 1864, was the result of the experience gained in 1862 and 1863; in other words, that the practical training of two years was required to create a corps *d'élite* which promised any chance of success.

What is the best organization for the *personnel* required we shall not inquire into; it is enough for our purpose to show that a military railway corps is now admitted as indispensable, and to allude to what its principal duties will be on service. The details for its organization can be far better left to a committee of experienced civil and military engineers to deal with. There can, however, be little advantage in attaching a division of the railway corps to each army corps, as advocated by some writers; their work will be principally on the line of communications, they therefore should be under the Inspector-General of the Line of Communications, and not attached to any army corps.

In Germany there is a special line, called the military railway, running from Berlin to the artillery practice ground at Zossen. We have nothing of the kind, and all the instruction on railway matters is imparted at Chatham, and forms part of the regular engineering course of training.

Such a competent authority as General Sherman has pronounced against the formation of a special railway corps. In those States where general military service is the law, the inhabitants become part of the military organization, in these the Government, having plenty of men in the ranks already cognizant with every particular of the railway service for use in time of war, might dispense with a special railway corps. But if, even in these States a railway corps forms part of the army organization, we may conclude that experience

* The working companies are more necessary for us who cannot extend the working of our lines into the enemy's territory, and will have to land a complete staff for working the lines found in the country.

has shown that, however plentiful the men for the work may be, it has been found that the greatest advantages are only to be obtained when they have been united and exercised together in time of peace.

In war, the line which shall be found most convenient to employ, and which follows most directly the line of operations, should be carefully studied, all possible information regarding the same being obtained before the actual commencement of the campaign. The breadth of gauge, measurements of bridges, length of cuttings, viaducts, or embankments, position of tunnels, curves, gradients, situation of depôts and workshops, quantity and description of rolling-stock available, &c., should all be, as far as possible, correctly ascertained. This is not a difficult matter, for the yearly reports of most companies contain a good deal of the information required; statistical records will also contain much on the subject of railways which will be found useful.

An army in the field obtaining possession of a railway line will either use it or destroy it, both of which operations demand a special knowledge, theoretical and practical.

Partition of Work between the Railway and Military Staff.

Railway arrangements can be divided into two distinct parts, those that belong to the railway staff, and those that belong to the military. To the first appertains the collection of the necessary rolling-stock, the entire movement of the trains, the preparation of the time tables on data furnished by the military, and the arrangement of the proper size of the trains to ensure the full power of the locomotives being neither exceeded nor wasted. To the second belongs the fixing of the entraining, detraining, and transfer stations, the demands for trains for the different arms, the order in which trains are to follow each other, the movements of troops to and from stations, and the entraining and detraining. The mutual responsibility of military and railway officers should be clearly defined to obtain a smooth performance of their respective duties. The military can do no good in interfering with the technical part of the work; however, strictly speaking, the employment of railways for military purposes is not so much a technical question as a staff one, for it demands an intimate knowledge of the composition and requirements of an army, which is the study of the military staff but is not necessary for the technical railway officer to acquire. An experienced railway official must be at the head of the railway to superintend that portion of the work with which it is impossible for a military officer to make himself thoroughly acquainted without an immense amount of experience, which can only be obtained by those who have for years been daily connected with the working of an important line.

The supreme direction of a large movement of troops by rail must be entrusted to one, and that a competent and experienced person; thus only can we guard against disorder, wrong directions, and conflicting instructions. To this director will appertain the duty, as soon as the orders of the Government have been communicated to him, of assigning to his different subordinates the part which each will be called upon to perform, according to the exigencies of the service. To arrange the whole movement he must be accurately informed of the composition of the army, the strength of each tactical unit, the

points of entraining, and the destination of each part. Without this information it would be impossible for him to make suitable preparations, to form a correct estimate of the rolling-stock required, and of the probable time in which the operation will be completed. To furnish this information a military officer of experience must be associated with the technical director, the two working together the military requirements will not clash with the technical part of the work. Thus, if any impossible movement be proposed, or a demand made which is out of the power of the railway to comply with, there will be an officer (the railway staff officer) to listen to the objections or remonstrances, and to judge and to provide accordingly. Once the details have been furnished by the military director, or railway staff officer, these should not without good reasons be altered, for any alteration will lead to loss of time and confusion; trains for cavalry, artillery, infantry, engineers, and provisions, being composed of a different description and number of carriages, cannot be substituted one for the other without inconvenience.

The order in which troops should arrive at the detraining station, according as they will be most needed, should be carefully considered beforehand; this depends a good deal on the nature and position of the point of concentration itself. As a concentration is only likely to occur at certain principal points of a frontier, it will not be a difficult matter to foretell what troops will first be necessary at each point to secure the concentration from being molested by the enemy. In order, however, to make the best use of the rolling-stock, platform accommodation, and *matériel*, it will be necessary to portion off the troops of the different arms in a certain proportion for transport each day during the continuation of the movement.

The arrangements between the technical and military directors should be carried out without any interference from other parties. All questions from military officers regarding the preparations and movement being telegraphed to the railway staff officer alone, who is the proper channel for such communications.

The necessities of the military service may demand the total suppression of the ordinary traffic, as would take place during large movements of concentration, or the traffic may be partly interfered with or not at all, such as would be the case when the concentration being completed, the lines are used only for purposes of supply. Even in this latter case the lines may be for some days used entirely to convey provisions and stores to the base, which the movement of the troops had until then rendered impossible. The stoppage of the ordinary railway traffic causes serious loss to a commercial community, and should be limited as much as possible. It should be also remembered that large cities are now greatly dependent on railways for their supplies, therefore the total suppression of the ordinary traffic, to the exclusive advantage of the military operations, cannot be carried out without causing serious inconvenience. To give an example: in 1870, in France, only a week after the ordinary traffic on the Chemin de l'Est had been suppressed, the authorities at Metz were begging of the company to afford transport for those articles which are necessities of life; those at Strasbourg for the conveyance of salt.

Railway Station Commandants.

Experience has shown that where railways are used for military purposes some military officer is indispensable at each of the stations

where the troops touch on the way. At all entraining, detraining, feeding, or resting stations, therefore, should be a military commandant, who is directly under the orders of the railway staff officer, and whose instructions he is to see strictly carried out. These officers, who are, so to say, military station masters, should possess a certain knowledge of railway traffic, having, in the discharge of their duty, to watch that both the military and railway regulations are carried out. They should know the principal rules which regulate all railway traffic, the regulations regarding all military transport by rail, the railway station service, subsistence of the troops, billeting, accounts, &c., and, if in a foreign country, should possess a fair knowledge of the language of the country. In railway stations where provisions are to be prepared and issued, or where the sick or wounded have to be tended, commissariat and medical officers should be attached for these purposes.

The military railway station commandants must be present at the arrival and departure of every train, and they should be authorized to give directions even to officers superior in rank to their own on matters affecting the entraining, detraining, or transit of the troops. They should supervise all loading and despatching from their station, watching over the state of the rolling-stock, and seeing that it is completely utilized, securing that everything required by regulation is furnished, that the necessary loading apparatus is provided, the stations and approaches are properly lighted, and the platforms kept clear and accessible. In unloading they should see that no obstacle is in the way of a train entering the station and moving up to its assigned platform on arrival, that the detraining is rapidly effected, and the empty rolling-stock is sent back without delay. Troops on arrival at their detraining stations must quit the train under any circumstances or the movement of the following troop trains will be all thrown out. Military railway station commandants have further to secure the protection of their station and to keep ready reconstruction trains with proper gangs of workmen to proceed to any damaged or destroyed part of the line.

The officers particularly adapted for this service are those who have given already signs of superior intelligence, who are good linguists, active, and energetic men, full of resources, with no fear of responsibility, and possess a fair knowledge of their profession; they must be further physically fit to stand the constant work, which at times will be very severe. In peace time some officers might with advantage be sent to different railway stations to become acquainted with the traffic arrangements and details of the railway service.

The military railway station commandants should not permit the conflicting interests of the military and departmental staffs to trouble the technical officers by claiming priority in the necessity of their demands for railway transport. The commandants must be the best judges of what needs carriage most. All counter-orders, alteration of route, &c., can only cause confusion, and should be guarded against as much as possible.

The *personnel* of the entraining stations will have to be increased, for a large number of hands will be needed to prepare the trains. In a continuous movement, extending over a certain number of days, the *personnel* must be relieved at regular intervals for rest, or they will soon knock up. The men also must be robust to stand the heavy strain which the extra work will entail. Lighting and preparing a train will need five hours, and all trains should be ready half-an-hour before the time fixed for entrainment. To fix on an average time for loading and entraining is not so easy as it appears; generally the time laid down is fixed from experiments, and these are generally tried under too favourable circumstances. In carrying out experiments officers and

men, knowing it to be a trial, endeavour to be as smart as possible, it is only, therefore, from an average of a large number of trials carried out under all circumstances, that a tolerable correct average of time can be arrived at. With everything well arranged it will require half-an-hour to put a battalion of infantry in a train, one hour for a squadron of cavalry, one and a-half hours for a battery of artillery. In a continuous movement of troops by rail the entraining and detraining must continue by day and night. The darkness at night, rainy and tempestuous weather, the fatigue of troops arriving at the station after a long march, will have some effect in increasing the time required for entraining and detraining. The operation of entraining should be divided as much as possible by bringing into play all the principal and subsidiary passenger and traffic platforms and every siding provided with a platform; and railway stations, when used for military purposes, should be strictly closed to the general public.

Platform accommodation, end and side loading.

The troops may be called upon to erect temporary platforms where the permanent ones are found insufficient, to increase the capacity of a railway station, and they will also have to furnish fatigue parties to load and unload wagons; this last duty belongs entirely to them, and to parties of porters and carriers engaged specially for the service, so that no additional hands will be required from railway companies for this purpose. The companies, however, must see that they have sufficient hands to prepare the different trains, and a proper and sufficient supply of fuel and water, the consumption of which, particularly during a large movement of concentration, will be considerable. The proportion of coal to water is 1 to 8; in one hour an engine consumes about 8 cwt. of pit coal and 660 gallons of water. The more or less consumption of coal depends on the ability of the driver: where the inclines are considerable, the engines consuming a great deal of steam require more water.

No large continuous rapid despatch of troops by rail can be carried out without a sufficiency of platform accommodation, to allow of several trains being loaded at the same time. Infantry is the only arm of the service that can entrain and detrain anywhere on a line, dispensing with platforms, as long as the train is not standing on an embankment or in a cutting, and even in these cases it can do so, though the process will be longer and some risk will be incurred. But even with infantry, the officers' horses, those of the regimental transport, the baggage and reserve ammunition wagons cannot be entrained or detrained without platforms.

Platforms are indispensable where horses, guns, wagons, baggage animals, sick and wounded, stores, &c., have to be entrained or detrained; these may be permanent or temporary. Where the existing platform accommodation is found insufficient, it is preferable to extend and enlarge it rather than to erect a supplementary one. In all military districts the Quartermaster General's Department should possess all necessary information regarding the capacity of the railway stations, with detailed particulars as to platform accommodation, sidings, sheds, &c. In India there might be a branch leading from the main line to each military cantonment for military movements by rail. The cantonments are generally a long distance from the station, and at present the stations are, as a rule, ill-suited for military purposes, a separate platform in cantonment would therefore facilitate matters considerably. These short branches might be kept in repair by the military, under the supervision of the executive engineers, and would be convenient

for carrying out a periodical instruction of the troops in entraining and detraining, spare carriages being borrowed from the railway companies for the purpose.

Platforms should be nearly level with the floors of the wagons to facilitate the entraining of horses, guns, baggage, and stores. They should be of such a length as to take in the whole of a train at once, and should be made accessible for horses and carriages by means of easy ramps. Sidings are the most convenient places for supplementary platforms, and, if the platform is continued round the end of the siding, it will come in useful for either end or side loading. Of the existing platforms, as a rule, those for travellers are generally assigned to the infantry, those for merchandize to the cavalry, artillery, engineer train, and supplies. Not to interfere in the slightest degree with the traffic or block the line, at each principal station there should be three platforms specially assigned—one to infantry, one to cavalry, and one to artillery, commissariat, ordnance, etc.; these, if arranged in echelon, would permit of one troop train moving without in any way interfering with the rest.

In calculating the length of a train, it is customary to allow 20 feet for each carriage, a train of from 30 to 35 carriages will therefore occupy a length of from 200 to 233 yards. In calculating, however, the length of a platform, it will be advisable to allow of a good margin either to take in a train with a larger number of carriages than the above, or one that has somewhat overshot the mark in coming into the station. Where the ramps to admit to the top of the platform are only practicable at the extremities the platform must be wider than would be needed if there was a continuous and easy ramp along its whole length to afford more room for men, horses, and wagons to pass each other. A ramp of earth revetted with four sleepers on the side of the wagons can be thrown up by a working party in one hour: to economize labour a narrow platform can be thrown up with broad places at intervals corresponding with the doors of each wagon or truck. Temporary platforms can be readily prepared with railway sleepers where a supply of spare ones is found available. A platform of this kind is composed of a succession of bays, each bay consists of tiers of sleepers, three laid perpendicular to the line and two laid longitudinally above them at each end. Seven tiers of sleepers will give a sufficient height, 18 sleepers being required for each bay. As many bays are prepared as the length of the platform needed; on the top a row of consecutive sleepers is laid along the whole length, perpendicular to the line. The materials are available for other uses afterwards, and a platform of this kind can be put together quickly without skilled labour.

The Railway Transport Committee, assembled in India under Lieutenant-General Sir Charles Reid, inquired into the system of end-loading for military purposes, so strongly advocated by Sir Charles. This leads us to consider the two systems of end-loading and side-loading. The first is where the doors of carriages, trucks, wagons, etc., open only on each side in the ordinary manner, requiring the wagons being brought alongside of a platform to take in separately what each one has to convey: this is the system universally employed in loading railway carriages. The second is where the two ends of each wagon, truck, &c., are fitted with hinges which can be let down resting on the buffers, thus turning the train into a continuous platform from end to end. In this second case a portable ramp is needed for each end of the train to allow the horses and wagons to ascend and descend. The advantages claimed for the end-loading system are increased rapidity in entraining; entraining being possible in sidings or in any part of the line, and

detraining wheresoever a train may stop in transit, independent of platforms. The latter method is principally applicable for cavalry, horse, field, and mountain batteries, transport, engineer train, and cattle; side loading being preferable for infantry, sick and wounded, heavy guns, stores, and supplies.

The system of loading trains in general use is the side loading; it may be doubted if the advantages in point of time claimed for the end loading system would not be counterbalanced by a certain loss of time caused by a departure from the customary way of loading, which practice has made all familiar with. End-loading demands also a rolling-stock prepared for the purpose, which is not fully applicable to passenger carriages and covered wagons, and, though the advantage of detraining rapidly on any part of a railway line cannot be denied, the cases requiring it would be comparatively few, so that the operation would be resorted to only in exceptional cases. A very considerable objection has, besides, been raised against the end-loading system, viz., that the line between two stations is thereby blocked, all traffic having to be suspended as long as the troops are either entraining or detraining.

Besides plenty of platform accommodation there should be an abundance of sidings at the principal stations, for without them a large collection of rolling-stock becomes impossible. Commissariat and Ordnance Stores require special sidings and take a long time to load and unload. *Pippre* allows two hours to unload 40 wagons, and recommends to calculate three hours as necessary; *Hazen-kampf* gives not less than two hours to unload a train of 25 to 30 carriages: others consider that even more time will be needed. Without a sufficiency of sidings there will be to a certainty a block in the traffic. Parallel temporary sidings, communicating with the main line, can be quickly and roughly made on the American plan for making hasty railways; the ground is roughly levelled and the sleepers are placed within a foot of each other; as the trains will move on them at a very slow pace, these sidings will be found stable enough.

Gangs of porters are needed at all the entraining and detraining stations to load and unload the wagons quickly, and make room for the next train. Where there are plenty of low-sided trucks it will save much time and labour to run loaded carts on them, and send them thus to their destination. On arrival, horses have only to be sent for them, the carts are removed from the trucks, and, without any further loading and unloading, the goods are conveyed to the corps, dépôts, parks, &c. This plan was often adopted by the Germans in their last war, it saves time, though the whole of the carrying capacity of each truck is not fully utilized.

It should be borne constantly in mind that railway wagons are not to be used as temporary magazines, for the sooner they are unloaded the sooner they will become available for further use. If there are not sufficient soldiers for working parties to unload them, the people of the country must be utilized for this purpose. Were a number of provision trains to be pushed quite close up to an army, only to be unloaded as the contents are required, there would ensue a block of the line extending for miles, rendering a large quantity of matériel and personnel idle. The wagons must be unloaded and sent back without delay, and the platforms cleared at once to prepare for the reception of other trains arriving. *Jacquemin* gives an account of the encumbering of the Metz railway station in 1870, and shows that whilst this sad state of things existed, there were numbers of requisitioned carriages in the town of Metz unemployed. We have also a later instance of this, for, writing from Sukkur on the 21st December, 1878, a correspondent

of one of the papers says: "he saw the platform of the railway station encumbered with cases, bales, and packages of all sorts, sizes, and descriptions, some addressed to the transport officer, and having their contents properly labelled outside, but for the most part without any distinguishing mark whatever."

There may appear to be want of foresight in unloading provisions which may soon have to be forwarded again by rail to the army; but acting otherwise, we should run the risk of accumulating a large quantity of provisions and rolling-stock in too dangerous a proximity to the enemy. A certain number of provision trains only need therefore be kept loaded, echeloned in rear, ready to be sent forward to the army, to be replaced by a like number. As all lines, as a rule, should be kept as clear as possible of loaded trains, great care should be taken to avoid pushing up to the front many trains containing objects of secondary consideration, whilst the troops may be wanting in what is actually necessary.

Two important considerations in the working of a railway for a continuous movement of troops are, the interval of time within which succeeding trains can be started, so as to avoid all risk of accidents, and the rate of speed a continuous convoy of trains can safely travel at. In England, on double lines, the fixed interval between two succeeding trains is half-an-hour; in France a maximum of 24 trains a day is the regulation on double lines; in Germany, during the mobilization, 18 trains per diem were despatched on double, 12 on single lines.

In the ordinary working of a railway line, the rate of speed is amongst other causes affected by the inclines, and by the train having frequently to pull up at different stations on the way to set down and take up passengers, to take in water for the engine, or to change the locomotive. The movements of the trains are besides regulated with due consideration to trains crossing the line at certain points, entering or quitting it, and to the different rate of speed of mail, ordinary, and goods trains which require the shunting of the slower ones at certain points to permit of the faster ones getting ahead.

For a continuous movement such as a concentration of a large body of troops a uniform rate of speed is indispensable; without it such complications would arise in the working of a line as would make it impossible to guard effectively against accidents. The crossing of the line by other trains should be so arranged as not to interfere with the continuous progress of the troop trains. The real maximum possible speed of a train depends on the drawing power of the engine, the steepness of the gradients, and upon the precautions deemed necessary for the prevention of accidents. No advantages can be derived from exceeding a certain rate of speed per hour, for the distance between two succeeding trains will have to be increased to avoid accidents, heavy engines will also have to be discarded, as they cannot exceed a certain rate of speed, and a smaller number of carriages will have to be assigned to each engine. Regularity being the essential condition in a large concentration by rail, it is evident that it can be better obtained by the adoption of a moderate rate of speed which will permit of any delays at starting being made up in transit, which would be impossible were the maximum rate of speed the rule. The speed of all trains in transit varies with the slopes of the roadway, and when a train is said to go 20 or 30 miles an hour this expresses that such is the mean of various degrees of speed, some greater some lesser, it assumes whilst going over the various sections of a line.

The movement by rail can only be very rapid on double lines, as the

number of trains started on single lines depends upon the number of places where trains moving in opposite directions can pass each other, for the passing of each other can only be done at fixed stations, where the first train to arrive will have to wait for the arrival of the one coming from the opposite direction; when it proceeds, the length of the line up to the next station must be clear for its passage. The further these stations are from each other the longer the line will be unoccupied. The carrying power of a single line is very much increased by the number of passing stations; if possible there should be one at every 6th or 7th mile. In single lines by running trains in groups of two or three the movement can be accelerated.

The trains which have conveyed troops to the detraining terminus will return to the entraining station for more, and as the movement in both directions on single lines limits the number of trains that can be despatched, it will be well to look round and see if the empty carriages cannot return by some other line; moving as they would do at a faster rate than when loaded, even a slight *détour* would be of little consequence when compared to the advantage gained, of allowing the traffic of the single line to be carried out entirely in one direction. It will render the work much easier having these return trains (which should be numbered with the addition of the letter R.) re-formed at some large station on the way back so that they may reach the entraining terminus prepared to take up all the troops to be assigned to them without any re-arrangements of the carriages being necessary at the terminal station.

Platform accommodation, as we have seen, and sidings have also great weight in reducing the interval of time between the dispatch of succeeding trains by permitting several to be loaded at the same time. When the ordinary traffic is stopped and the troops undertake the entire business of loading and unloading trains some part of the *personnel* of the principal stations, and most of that of the intermediate ones, will be unemployed. A continuous rapid movement demands more signallers along the line and a portion of the hands now released could be thus employed with great advantage. Should, therefore, an accident happen to one train in transit, these signallers could rapidly stop the progress of the succeeding trains. Accidents are most carefully to be guarded against when a line is used for concentration, as a serious accident to one train will cause a delay in the whole movement.

The principal sources of accidents are collisions, of which there is a greater liability on single than on double lines; inclines, where the brakes may not be powerful enough to reduce the speed or not applied in proper time. Brakes are used for the double purpose of slackening the speed, and to avoid accidents from the breaking down of the rolling-stock: the employment of continuous brakes lessens considerably the risks of accidents. In curves lies a further danger of accidents, for the train or part of it may quit the line; the smaller the radius of the curve and the greater the speed the more chance there will be of an accident of this kind. Other sources of accidents arise from fogs, faulty or mistaken signals, carelessness, and negligence. By the military use a line suffers more in every respect than when used for ordinary traffic, for, when trains are numerous and running at very close intervals, there is little opportunity of attending to those repairs which a line continually requires. To guard against accidents in transit all military trains should be furnished with means of signalling, and for detraining independent of stations, and that he is supplied with such means the officer commanding should ascertain before he starts.

With all proper precautions, the interval of time between succeeding trains can be considerably shortened, and successive trains could

even follow each other safely on double lines with an interval of from 10 to 15 minutes, if required. The distance between two trains would be ample to permit of their pulling up when signalled to stop. A very rapid succession of trains will, however, seldom be needed, though there might be occasions where this might be necessary; for example, where it is desired to send as large a force as possible to occupy some important place without delay, or where a large reinforcement has to be conveyed to strengthen an army in the expectation of a battle, &c. If the troops are all infantry, the entraining and detraining taking a very short time, trains can be started in rapid succession, but the same does not apply to cavalry and artillery, for with these arms these operations take a long time. The capacity of the entraining and detraining stations being limited, the entire movement must be conducted with due regard principally to this point. A very rapid despatch, therefore, can only be necessary in very exceptional cases, and over a short distance, where proper preparations can be carried out.

On the good system observed in the entraining of men, horses, and *matériel* depends to a certain extent the rapidity of despatch of successive trains; troops that have been practised in entraining and detraining will require less time than troops that have not been so instructed, hence their being drilled to this is a great point in their military education. A point, we may remark, the importance of which, though acknowledged by all, has not received in practice all the attention which it deserves. The entraining and detraining should form part of the instruction of troops at all large stations, or, at all events, at all camps of instruction. Even in stations far removed from railways, some course of instruction in the barrack square on the plan the French have lately adopted, of marking the floors of railway carriages on the ground with wooden frames, pick-axe, or with cords, and thus practising the men in military entraining, might be instituted. Old carriages and trucks might easily be kept at certain military stations for practice in entraining and detraining.

It should not be forgotten that the principal point which will determine the number of trains to be started in a certain period of time is the capacity of the detraining station; for it would be of no use to despatch more trains than that station can make room for, this would only encumber the line with a large number of trains waiting for their turn to unload; an encumberment which will be always more dangerous the nearer the station is to the enemy. The men, and particularly the horses, which should be kept in the train as short a time as possible, will get more fatigued, and the confusion will steadily increase. We cannot insist too often in repeating that the key to the whole movement of concentration is the capacity of the detraining station, and the abundance of means for rapidly unloading the various trains as they arrive; it will be of little avail to despatch trains in rapid succession if they cannot proceed and are obliged to remain a longer or shorter time out of the detraining terminus. The calculations of the time tables should be based on the consideration that all the arrangements will fail, unless they are made with strict regard to the capacity of the terminal detraining station to take in in succession the different trains on arrival, and permit of their unloading at once, leaving in a certain time the platform clear for the next train that has to use it. By not allowing two trains with the same charge to follow each other, sufficient time will be gained to permit the first train unloading and clearing the platform before the arrival of the second one of the same description. To compare a military movement with the large movements of passengers by rail that take place at large

race meetings and on public holidays is an error, for there is no parallel between the two; in the latter each traveller has for object to secure a place as quickly as possible, and at the end of the journey to quit the station and go his own way, he has little or no baggage whatever, but the soldier has his baggage and his arms, and has to form up and march away with his comrades in an orderly formation. Besides, an army is composed of artillery, cavalry, infantry, engineers, transport, &c., with an immense number of horses and carriages which demand a long time to entrain and detrain. It will be seen by this that with the very best arrangements, with a plentiful supply of rolling-stock and a good staff, only a limited number of trains can be despatched each day. Our regulations state that "No more than 20 trains have as yet in war time been despatched with troops in one day from any one station." An Austrian authority gives 25,000 infantry, or, at the utmost, a strong division of the three arms, as the most that can be conveyed by one railway in one day. The interval of time, therefore, between the departure of succeeding trains will be considerable enough to guard against accidents.

The trains which have conveyed the first troops are sent back from the detraining terminus. Empty trains travel quicker than loaded ones, and their rate of going can be laid down at three-fourths of when loaded; this is caused by the diminution of the load, as in loaded trains the weight of the passengers nearly equals that of the carriages, besides, fewer halts are necessary. After their return, the carriages have to be examined and cleaned, and some hours will elapse before they are ready for a second trip.

Pippre gives the following formula for finding the time that will elapse before the same carriages will be available to start for a second trip.

T. = Time in which the return rolling-stock will become available.

D. = Duration of journey going.

$\frac{3}{4}$ D. = Duration of journey returning.

L. = Loss of time in entraining, detraining, examination of engine, cleaning carriages, re-forming train and rest of engineers and guards, which he states experience to have shown to be on an average 18 hours.

$$T. = D. + \frac{3}{4} D. + L = \frac{7}{4} D. + 18. h.$$

Locomotives work by sections, and require changing after a journey of about 80 miles, though this depends very much on the description of locomotive used; after arrival at the engine changing station, about two hours should generally be allowed to examine the engine, clean up, &c., before starting it again. A number must be collected at stated intervals, with a reserve to employ in cases of breakdown or where extra power is required to help heavy trains over difficult parts of the road.

The rest allowed to the engineers and stokers should equal one-half of the duration of their working time. *Marcille* gives 5 hours and 50 minutes for the duration of a journey of 150 kilometres, allowing the same time for the return journey, and an interval of 1 h. 20 m. to examine the engine, they will be back at the starting station in 13 hours: 11 hours out of the 24 remaining for rest, for examining the engine, lighting and preparing for a second trip.

It has been the custom to assign one or more trains to each tactical unit, so as to avoid mixing men of different regiments, and principally of different arms of the service, as much as possible in transit, but in a large movement of concentration by rail it would

somewhat retard the completion of the concentration were the number of carriages to a train to be determined solely by the strength of the various tactical units. Why sacrifice a portion of the carrying power of a train to a tactical unit, when such technical conditions as the power of the locomotives, the gradients on the line, the rate of speed, and the condition of the line itself, go principally to determine the maximum number of carriages to a train? In the war of 1870-71, the number of carriages to a train in both armies was determined by the power of the locomotives. Besides the effective strength of a battalion, squadron, or battery, is subject to many variations, and it is no use preparing trains to carry a tactical unit, if that unit is not kept complete in numbers. Would it not be preferable to attach less importance to these tactical units, and to consider a convoy of so many trains as detailed to convey a tactical unit, but of a larger kind? The number of carriages to each train would then be determined by the technical director, who would still keep in view all the advantages of despatching a tactical unit complete, but only as long as by this arrangement none of the carrying power of a train is sacrificed. Any carriages or places beyond those required by the tactical unit being filled by the military commandant at the entraining station, with details from the same arm, if possible, and belonging to the brigade or division they form part of.

The several trains detailed for each convoy would then start successively, no other train being permitted to intermix with them, the same order being maintained during the entire transit. With each convoy might be sent one or more trains with provisions and forage, but it is preferable to move the troops first, and they should take with them provisions for several days, which would enable them to quit the neighbourhood of the detraining station immediately after detraining. As each unit will travel with its regimental transport, it will have besides one or more days' reserve provisions ready at hand.

Entraining of the Various Arms.

The rolling-stock required for the transport of a Division and of an Army Corps, the number of trains, the composition of these and other details, are to be found in the Army Circulars of the 1st June, 1878, pages 48 to 63. Tables for India, where the circumstances are different from what they are in Europe, will be found worked out in the various papers on the adaptation of railways for military transport:—Progress Report of 1877; Preparation of Military Time Tables for the Concentration of Troops, 1878; Notes on the Recent Movement by Railway of Bengal Troops to Bombay, 1878, etc.

Troops sent on service by rail must be entrained complete, with their camp equipage, regimental transport, reserve ammunition, entrenching tools, &c., to be ready for anything as soon as they quit the train. A further advantage of troops travelling thus complete in every respect is, that, should an accident occur, or the line get blocked, the troops can get out of the train and move on by the ordinary roads. Troops of all arms must arrive at the station some time before the hour fixed for the departure of the train that has to convey them; this time depends on the preparations necessary to stow everything in the train. No ammunition, powder, and other dangerous combustibles (except battery ones packed in proper artillery wagons and infantry reserve), should ever be sent by the same train as the troops travel by, and all proper precautions should be taken to guard against accidents with trains conveying ammunition. The wagons should be easily distinguished by being painted red or otherwise marked, and should always be sufficiently guarded.

FIG. 1.

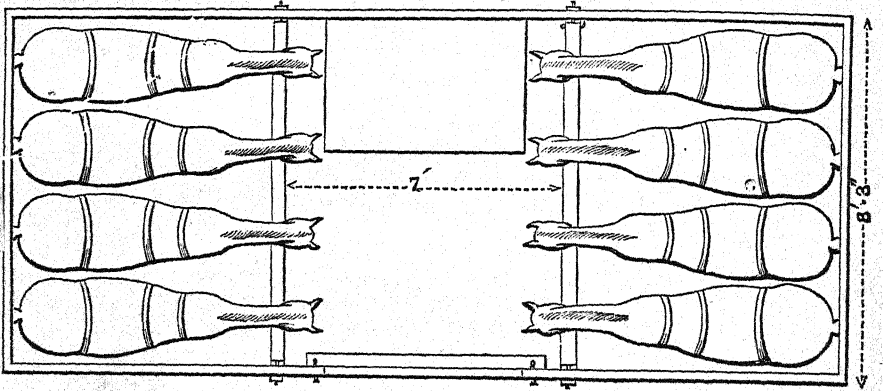
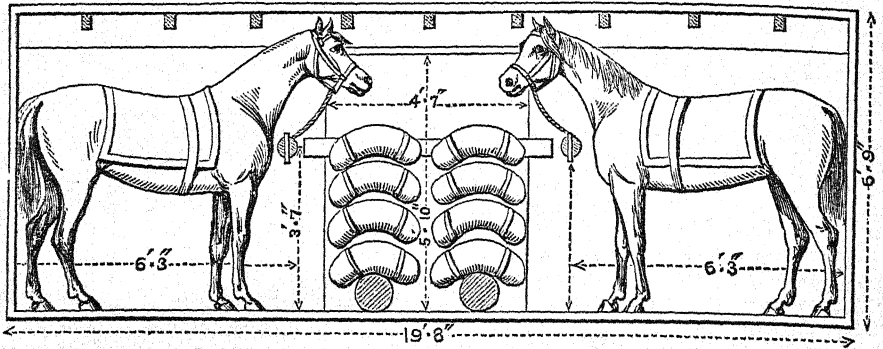
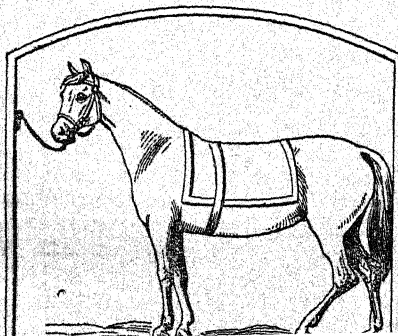
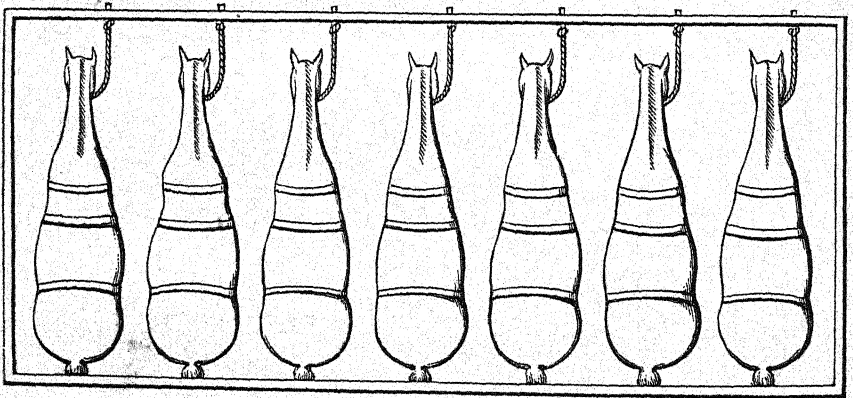


FIG. 2.



Too minute details for entraining are only puzzling to the soldier; the instructions should be few and very simple. Order and quiet is what is needed, and as long as these are maintained a certain latitude can be granted to the soldier in getting into the train, securing his things, and accommodating himself.

For infantry the usual passenger carriages, 2nd or 3rd class, are used, ten seats being allotted to every eight soldiers; two seats in each compartment being left unoccupied to afford more room to the men, hampered as they are with their packs, arms,* &c. In large movements of concentration the usual passenger carriages would of themselves be insufficient for a rapid despatch of troops, and use must be made of all rolling-stock which, with slight alteration, lends itself to the transport of men, and which, owing to the total or partial stoppage of the traffic, would also remain unemployed. Goods wagons have not the same easy springs as passenger carriages, and the motion of the train is felt more in them, still often the accommodation they offer is better than what is found in a 3rd class carriage. Covered goods wagons can be used for infantry, twenty men with their kits and tents going to a wagon; high-sided wagons can likewise be fitted with moveable benches to carry from 24 to 30 men. In India it has been ascertained that 16 men with their kits and tent can conveniently occupy a covered goods wagon; this is a convenient number, for 16 men occupy an European private's tent. Every carriage used for the transport of troops by rail should be provided with means for the men to satisfy the calls of nature without leaving the train. In carriages which communicate with each other by end doors this can be easily arranged. The entraining of infantry presents no obstacle, and can be done very rapidly, the regulations of the 1st June, 1878, calculate that 40 minutes will be required for an infantry train with regimental transport. Two trains are required for each battalion, and all infantry trains are ranged under Class I. The best order for the carriages and wagons to follow each other is as follows: the engine, one half of the carriages for the men, the officers carriage, the other half of the men's, horse-boxes, cattle-trucks, low-sided wagons with regimental transport carriages, and brake van. The infantry should arrive in the neighbourhood of the station one hour before the departure of the train; where this is not possible, the regimental transport should arrive at all events at the entraining station half-an-hour before the troops.

The train unit for cavalry is the squadron. The floors of all cattle-trucks and other carriages used for horses should be very carefully examined before the horses are put in the train, to make sure of their being strong enough to bear the weight of the animals, and not giving way to their pawing. Cross-battens nailed to the floors give a firm hold for the animals feet; stable litter and loose earth would have the same effect, besides presenting the further advantage of deadening the sound of the horses' feet on the wooden floors. Cavalry, if possible, should entrain by day, the operation being always carried out by men thoroughly acquainted with the horses. The operation is long, and various platforms should be devoted to this purpose when these can be spared. The horses should be fed two hours before entraining.

For a large movement of cavalry and artillery it is impossible to use horse-boxes alone, for their use would inconveniently lengthen a train, besides which enough of this rolling-stock is not available;

* In the French regulations soldiers travelling without arms or equipment are allowed the same accommodation as other travellers; if armed and equipped 10 seats are allowed for every 9 men, for journeys under 150 kilometres, and 10 for every 8 men for journeys above that distance.

such of these are available are generally detailed for the officers chargers. Cattle-trucks, high-sided open goods vans, and covered goods wagons can be used whenever certain requisites as to height, width of doors, &c., are found. The latter are the most convenient, as they afford thorough protection from the weather, and it is possible to feed with hay; in the other wagons a certain danger from sparks from the engine is incurred. In hot countries iron wagons are only suited for horses if lined with wood, without this the heat will burn and blister the horses' skins. When covered goods wagons are used for horses, bars are required to place in front of the horses, and across the doors. In winter 3 lbs. of straw for each horse should be provided for bedding, but smoking should be strictly prohibited in all wagons and carriages where straw is supplied for the floors.

Horses can be arranged in the wagons in two ways, either in one line, perpendicular to the rails (Fig. 1), or in two lines parallel to the rails, and facing each other (Fig. 2). In the first case the loading is more rapid, and there is less strain on the animals when the train moves off or stops; in the second there is more facility for feeding and watering, more comfort and better protection for the attendants, and room for forage and saddles. Both ways of placing horses in wagons parallel and perpendicular to the rails have their advocates, and both have been employed, still no conclusion has yet been arrived at as to which method is the best. Horses have often been placed parallel to the line for want of breadth in the wagons, and for no other reason; in this way they appear more tranquil, have better air, and can feed and drink with greater ease; it requires, however, wagons with a minimum interior length of 18 feet to take in two rows of horses with their saddles and forage. When horses are placed perpendicular to the line their heads should face away from the second line of rails, as they are very apt to be alarmed by other trains passing; travelling in this way extra wagons will be necessary for the saddles, if the horses are to be unsaddled. The resistance which horses show to entering the wagons and trucks arises from the fear of the carriage, and from the noise the hoofs make on the loading board. Horses accustomed to travel by rail are more easily entrained than young horses, particularly remounts. For these latter the end loading system is preferable where the train forming a continuous platform, the horses follow one another without difficulty. In all cases a quiet horse should always lead.

A truck will take from 6 to 8 unsaddled horses in both ways, even 9 have been put in a truck in one row in India, but there the horses are small, and this can only be resorted to in a case of emergency, as the horses get stiff, and there is no room left for the attendants. Much will therefore depend on the size of the horses, and capacity of the wagons and trucks; some will not accommodate more than six horses; in any case the animals should be placed sufficiently close as to be unable to move much; this is an essential point upon which depends a good deal of the success of the movement. A space of 2 feet 9 inches in breadth should be allowed for each saddled or harnessed horse, and of 2 feet 3 inches for horses without trappings. Where there are stallions, as, for example, in the Indian Cavalry Regiments, a gelding should be placed between every two entire horses. In covered wagons the heat may demand the horses being placed a little further apart.

If the horses are conveyed saddled, the room in each truck or wagon will be somewhat curtailed; except for short distances, for journeys under six hours, horses should be unsaddled, for more room is thus obtained and fewer wagons are needed, it makes the horses feel more at ease, and improves the hygienic conditions; there is

less difficulty in getting them out of the train, and the saddles are not liable to be injured. The bridles should in all cases never be removed until the operation is completed, and are to be put on again at the last station before arriving at the detraining terminus. As a rule for universal application, horses should never be kept saddled except when they are required for use; this rule is complied with by unsaddling during transit, though an exception may be made where the animals are conveyed in open wagons in cold weather over short distances, or where they are destined for a special service not very far off.*

When the horses are conveyed perpendicularly to the rails, extra wagons will be required for the saddles, at the rate of one for about 60 saddles. The saddles should be packed in rows, one placed on the top of the other, the lowest one resting on a roll of straw or hay, to prevent its getting damaged by the weight of the rest. To enable each trooper to recognize his own quickly when detraining, each saddle should have affixed to it a cloth label, bearing the owner's number and name.

One or two men will be required in each wagon or truck to attend on the horses, to feed and water them, to put them at their ease, and prevent their fighting; where horses are arranged perpendicularly to the rails the men on duty with the horses should be frequently relieved, for their place by the horses is not comfortable, and if not relieved they will quit it to search for some more convenient one; they are also there forbidden to smoke, on account of the loose forage, and this to many is a great privation, if continued too long.

Covered trucks require special arrangements to fit them for carrying horses; the ventilation is generally bad, and they are very close; iron ones are too hot in warm climates, and all alike are in need of some improved system of ventilation. When the troops went from India to Malta in 1878, the covered goods wagons used for the horses of the 9th Bengal Cavalry† had each twelve 1½-inch holes bored in the floor for drainage and ventilation, and "the upper panels of each door were removed, giving two openings on each side, each 2 feet 6 inches high by 1 foot 10½ inches wide." These wagons had iron panels and roofs, and were found, even with these alterations, unfit for the conveyance of horses during the hot season, as the horses suffered from heat and want of ventilation. Ventilation was much needed fore and aft, and the General Officer Commanding the Saugor district suggested small openings in the panels in front and rear, about the level of the horses' heads, or a little above them;‡ or even a few holes of an inch or inch and a half in diameter.

Horses conveyed in open cattle trucks during the severe heat of the day should have their loins protected by a blanket folded into four. Where the arrangements parallel to the line can be carried out, forage nets and temporary feeding troughs can be placed before the horses, which will tend greatly to quieten them. All covered wagons used for this purpose should be provided with a lantern at night.

The piloting of a cavalry and artillery train requires extra care, and

* The Austrians unsaddle when the horses are in the wagons, except at night and when horses are vicious. It is a quicker way of acting when there is plenty of room and, as they saddle after passing the last station but one, much time is gained, for horses detraining ready to be mounted.

† This Regiment was conveyed over 1,252 miles in 7 days, including halts; the movement took place at the end of April, about the hottest time of the year.

‡ In adapting covered wagons of the Scinde Punjaub and Delhi Railway for the carriage of horses during the Afghan war, the two upper iron panels of the doors on each side, and two panels at each end, were removed, thus sufficient ventilation was secured.

should never be given to any but to an expert driver. Anything which can frighten the horses, the whistle of the engine, for example, or any jerky movement which may cause their fastenings to come undone, should be avoided. In artillery and ammunition trains, more than in others, sparks from the engine must be carefully guarded against. All sudden shocks should also be avoided; the train should be started slowly without any jerk, and likewise stopped by degrees; going over curves the speed should be slackened to reduce as much as possible the lateral motion of the carriages.

The regulations calculate that one hour will be required to entrain a squadron of cavalry, and all these trains are classed as "C" trains. The horses should be entrained with great care; undue haste should be avoided in putting horses in a train for service, to ensure the animals against any injury in transit. The troops about to entrain should not enter the station-yard until the precise moment, as laid down in the temporary time tables. Non-commissioned officers and men should have been told off previous to their reaching the station to entrain horses and carriages, others to remain with the horses during transit, and others again to stow away the saddles. The rest should not enter their carriages until the whole of the horses, baggage, and carriage have been loaded; the telling off to the various compartments under a responsible non-commissioned officer should be arranged beforehand.

The best order for the carriages and wagons to follow each other is as follows: the engine, one-half of the horse-trucks, half of the men's carriages, the officers' carriages, other half of the men's carriages, followed by the remaining horse-trucks, low-sided trucks with regimental transport carriages, and brake van. If the horses are arranged perpendicularly to the line, some additional wagons will, as we have already seen, have to be provided for the saddles. In cases, also, where it is intended that cavalry should get out on the open line, independent of platforms, a low-sided truck with one or more ramps may have to be added.

Some signal should be pre-arranged by which the troopers may draw the attention of the engine-driver in case of accidents. At stations where horses are to be watered in transit, buckets should be provided, one for every two horses.

The train unit for horse and field batteries of artillery is the half battery. Artillery requires for the carriage of guns and wagons trucks with low sides, and the end-loading system is particularly applicable to this branch of the service.

As guns and horses have to travel in the same train, it is desirable to place together all the horse-trucks and all the carriage trucks, so as to allow the train to be loaded simultaneously from both ends. For the prevention of accidents the last three carriages of an artillery train should contain no ammunition. The horses will be conveyed in cattle trucks, high-sided, or covered wagons, and what has been said about cavalry applies equally to the horses of the artillery; they may be kept harnessed for journeys of about six hours or less, for longer ones the harness should be taken off and packed in the horse wagons or in covered wagons. Rather more than one goods van will carry the saddles and harness of a field battery. When the weather is fine and the rolling-stock limited, the harness can be placed on the trucks with the guns. The off-horses, and this applies equally to all draught horses, can remain harnessed without incommoding the animals much, or fear of the harness getting damaged, but care must be taken to secure the traces in such a way that they may not inconvenience them.

A gunner should ride on each truck containing artillery wagons, and nothing of an inflammable nature should be permitted on trucks

carrying ammunition. The gunners on the trucks should have some preconcerted signal for drawing the attention of the engine driver in case of accident. The regulations lay down that one hour will be required to load an artillery train. Artillery, Engineer train, and Transport train, besides having to entrain horses and men, have a varied quantity of *matériel* to load on the train, hence the operation of entraining cannot but be long. All the Artillery trains, with the exception of the ammunition reserve, are classed as "A" trains.

In the end-loading system some kind of portable ramp is necessary to allow the horses, guns, and wagons to detrain on any part of the line if required; the most simple will be undoubtedly found the best for service. An inclined plane made of four rails supporting sleepers placed transversely and bound with ropes, with a little earth or grass thrown over them to give a foot-hold for the horses, was found in India to answer well. The rails were discarded, only the sleepers covered with earth and grass being used, and this simple ramp was even found to answer for all purposes. In this latter case the lower ends of the sleepers were made to rest against stout pegs driven firmly into the ground. Whether the side-loading or end-loading system is employed, Cavalry and Artillery trains should always have some portable ramps or other substitute to permit of their detraining on the open line, independent of platforms. The French have one constructed partly of iron and partly of wood, which can be used for side and end-loading equally. The simpler the ramp is the better, for anything complicated is to be avoided.

For entraining the men and horses of the Engineer and Transport trains, the same steps are taken as for the Artillery, low-sided trucks, which, according to their dimensions, can take one or two carriages, are the most convenient description of rolling-stock for their *matériel*. The entraining of this may be accelerated by using cranes: boards, planks and beams must be further provided to connect the trucks with the platform or with each other, and wooden wedges and ropes to secure the carriages on the trucks. Each train should take the carriages with the men and horses belonging to them; some men are necessary on each truck to tighten the fastenings in transit, and to give warning if anything goes wrong which they are unable to repair.

Detraining.

Large stations should be selected for detraining, the richer they are in platform accommodation, sidings, sheds, storehouses, etc., the more suitable they will be for the purpose. Concentrations as a rule take place on the frontier, and frontier railway terminus stations generally abound in resources of this kind. Nowhere is strict order more necessary than at the detraining terminus, there, especially, all confusion and encumbering must be guarded against; the troops must quit the station as soon as possible after detraining, and without noise. If a halt is necessary it should be made outside the station where the troops should form; as soon as the companies quit their carriages, they should be marched on their coverers and formed outside. To expedite this the Regimental Serjeant-Major, a bugler, and the markers should travel in the carriage next to the Adjutant. If fatigue parties are necessary, they should return to the station without arms and accoutrements.

An advantageous use of railways for military transport purposes will only be secured when all that will have to be done has been foreseen and prepared. The least detail even should not be neglected. In detraining, the most rigorous order must be enforced for fear of seeing

confusion and complications arise, as these will only increase until in a short time they may become irremediable.

The horses and carriages moving with the troops should be detrained and should quit the station with them. In cases in which this is impracticable the train should be drawn to some siding to make room for the next coming in, but then there will be difficulty in the subsequent detraining and risk of encumbering.

The station commandant who receives the troops at the detraining station must be made acquainted, either by telegraph or by post, with everything he is to expect, the order in which it is coming, and when it will probably arrive. He must have a detailed sketch of the entire movement, without which information it will be impossible for him to make proper arrangements and to provide for what the various trains convey. The station commandant must further be acquainted with the destination of every body of troops arriving, a staff officer being at the station to conduct them there, if the road is unknown to them. All provision and store trains should have bills of lading, with copies for the station commandant and administrative officer to whom they are to be delivered.

The clearance of the immediate neighbourhood of the station is imperative; the troops must be marched off as soon as possible to some suitable place, some distance from the station. Carriages of all kinds will more than anything else encumber the approaches to a station, and their presence there should not be permitted. Should the station possess only one outlet, others must be prepared, these being completely separated from each other. Thus one can be told off for the infantry, one for the cavalry and artillery, and one for stores and supplies. Not only the station, but the approaches to it, must be closed to the public, admission on business only being secured by a pass.

At each detraining station there should be an officer to register everything that arrives, and in the order in which it comes. He should register all the *personnel* and *matériel* that arrives, and take charge of all unclaimed goods, noting where they are to be sent to.

Gangs of porters and carriers, under military officers, must be kept ready at the detraining station to take in hand at once the unloading of the railway wagons and the removal of stores, *matériel*, and supplies. Immediately the detraining station is fixed upon, officers should be told off to organize a body of carriers with a park of hired carriages. From 200 to 250 carriages will be needed to take up the contents of a provision train. If the trains follow each other with a short interval of time, and the magazines are far off, a relay of carriages and carriers will be needed: about eight men will be required to unload each wagon. The carriers and carriage park should be located in the vicinity of the station. The first should be fed and paid, and divided into gangs for the work under proper superintendents. Fatigue parties of troops might be employed in place of carriers, but practised carriers and porters, accustomed to this kind of work, will load and unload quicker than soldiers; besides the employment of soldiers about the station should be avoided when possible. The pressure will only last for a few days, during which the greatest order should be maintained, and above all the detraining platforms should be kept clear. Slides, lifts, cranes, &c. (where they can be had), should all be used to facilitate the work. If the place itself does not afford a sufficient number of carts, others should be called in from the neighbourhood: it will be as well to pay for the work, to secure its being done well, and without confusion.

The time required to unload a provision train should be noted; information on this point will regulate the despatch and the arrival of

the next train of the same nature. Few stations will afford sufficient space to receive the immense amount of stores an army needs, and except in the case where an immediate advance may necessitate the stores being taken on by rail, it will be better to take them out clear of the station. If suitable buildings can be found for their reception these should be used, otherwise the goods can be stacked in sheds, or even in the open when plenty of tarpaulins are at hand to protect them from damp, dew, or rain. Each kind should be kept separate, but to be able to do this, all stores before being entrained must be properly marked. In stacking stores, wide passages should be left between the different kinds to permit carts to circulate freely, and the necessary precaution of guards must not be neglected. Some safe, isolated place must be selected for powder and combustible stores, and these articles should be removed with special care.

Where there are local military authorities at a detraining terminal station, their duties should only extend to matters not concerned with the concentration. The entire business of the concentration will be effected better by the absence of conflicting interests and counter-orders, and should be left entirely in the hands of the staff officers detailed purposely to carry it out.

In the German arrangements, at the conclusion of a large movement of concentration by rail, it is considered desirable to grant one or two days' rest to the railway companies to enable them to put everything in order, to repair irregularities, and, in short, to re-establish the normal system of working. This is a wise measure, and one which will render the future use of the lines more valuable during the progress of the operations which follow the concentration.

Working lines in an Enemy's Territory.

The following points concerning railways in an enemy's country have to be attended to by the Staff of the line of communications:—

1st. The line being kept in thorough working order and being worked in an economical and safe manner.

2nd. The maintenance of the rolling-stock and proper alterations and repairs of the same.

3rd. The rapid execution of all repairs or restoration of the line.

4th. The erection of suitable works of defence for the protection of railway stations, bridges, viaducts, depôts, &c., and the guarding of the line.

5th. The completeness of the arrangements for forwarding reinforcements, supplies, and war *matériel* to the army and removing the sick and wounded, prisoners, war trophies, &c.,.

A striking difference requires to be noticed between the continental railways and any that may fall into our hands in an enemy's country. On the Continent, in frontier towns, the railways of two adjoining countries generally meet, and, if the lines are of the same gauge, are often even connected, so that the officials of one State can extend without much difficulty the operations from their lines on to those of the neighbouring state with whose people they have been in intimate relation for a long time before the outbreak of the war, and with whose lines they are well acquainted.* This is impossible for us, on account of our insular position, and, with the uncertainty of finding people to work under our

* At the outbreak of the Franco-German War of 1870-71, the French railway companies had 1,400 wagons running on the German railways, the Germans having 600 of theirs running in France. Both nations kept what rolling-stock the enemy had in their country, and the French lost thereby 800 wagons.

rule, we should have generally to embark a complete railway staff to work the lines found in the enemy's country, with which, mainly, our acquaintance will be very limited; a disadvantage of itself as it requires time for strangers to grow familiar with the peculiarities of a new line so as to work it efficiently. We shall not be extending our railway lines across a frontier, or working a foreign line that runs in conjunction with one of ours, as was the case with the Germans in the Franco-German War. There the case was mainly to undertake the working of a more extended line, principally with their own staff or with the addition of some railway officials who could be spared from the various lines of the State; though even there the difference in the size of the carriages, in the height of the bridges, &c., caused some difficulty at first, for example, at Varangeville, the German locomotives could not pass under the bridge of Saint-Phlin, and the road had to be lowered before the trains could pass.

The Germans endeavoured by violence or persuasion to retain the *personnel* and workmen of the French railways; they threatened the localities with heavy fines, in case of non-compliance, and to send the disobedient before a court-martial. Few, however, complied with the order, and most took to flight. The French *personnel* on the lines occupied by the Germans was very limited; the largest portion of the railway staff came from the Prussian and North-German Confederation lines, and a small portion from Bavaria. Artificers and workmen, even when offered very high pay, would not serve the Germans, and had to be replaced by gangs obtained from Germany.

The transfer station used by the Germans to show the limit of the civil and military section of a railway line, or where the control of the line and regulation of the traffic passes into the hands of the military, has not the same importance for us at first, for we cannot extend gradually the working of our existing lines into those of the enemy. Our semi-military railway administration would have to take possession of and work any line found in the enemy's country for military purposes only. However, according as the pressure of work on the line would become less and order is restored, the line should be partially given up for ordinary traffic. It should then be divided into two portions, one on which the ordinary traffic is allowed to share the line with the military, the other, embracing a certain space in rear of the army, where the traffic will be purely military. Where the line begins to be purely under the control of the military is the transfer station, and this is moved forwards or backwards in the course of a campaign, according to circumstances.

Everything which has to reach the field army from the rear must be collected at the transfer station, afterwards being forwarded, as required, by complete trains to the terminal station. The terminal railway station is the station in rear of the army which is selected from time to time as the point up to which the traffic may be conducted with safety. A sufficient quantity of supplies are kept at the terminal station and forwarded by ordinary means to convenient places for delivery; thus the terminal station becomes one of the advanced supply depôts.

Though what follows does not come, strictly speaking, under the head of transport, still the matter treated in the next few pages is indirectly connected with the subject, relating as it does to steps to be taken either to secure for us these improved means of transporting troops and matériel or to deprive the enemy of them, it was therefore considered desirable to allude to them in this chapter

Reconnoitring a Railway Line.

Reconnaissances of a railway line are of two kinds; first, those conducted leisurely in time of peace; second, those made in the vicinity of the enemy in the course of a campaign. The first are made to obtain all the possible information regarding a particular railway line which lies within the zone of intended operations, so as to prepare beforehand all that may be needed for repairing and working it in time of war; the second only aims at ascertaining the actual state of a railroad and what steps are needed to re-open it quickly for traffic.

In coming on an abandoned railway in the enemy's territory the line will be found always more or less injured, and the extent of the damage done to it must be correctly ascertained before turning it into use for one's own army. The line, therefore, must be carefully reconnoitred, and it will be as well to limit ourselves here to the consideration of the second case only.

Reconnoitring a line to ascertain its capabilities for working will principally be the duty of the officers of the railway corps, as to do this efficiently a variety of technical knowledge is required. These officers above all others will be best able to judge, owing to their previous training, if all that is needed for carrying on the traffic is to be found on the spot, and can devise how best to replace or supplement any that may be found wanting. The correct gauge of the line; the state of the road with regard to its security for traffic; the *matériel*, rails, sleepers, chairs, points, signals, &c.; the materials for alighting the engines, fuel and water; the serviceable or unserviceable state of all abandoned rolling-stock; the state of the engineering works, bridges, viaducts, tunnels, &c.; are all points which demand great attention. A good deal of information on all these points can be obtained by questioning the people who have been employed on the line.

There is no better contrivance for conducting such a reconnaissance than the trolley, for it requires no special knowledge to work it, it needs no experienced driver, and makes no noise.

In reconnoitring a line close on the track of the enemy all precautions should be taken, and the best way of conducting a reconnaissance in such a case is as follows:—The reconnoitring party moves with an advanced guard having cavalry scouts thrown forward to the front and flanks. The officer charged with the work, accompanied by a signaller or bugler, moves with the advance on a trolley, followed 500 yards in rear by a train with an engine at both ends. On meeting with any obstacle on the way the bugler or signaller warns the engine driver who reduces the speed and advances cautiously. Should the scouts meet with the enemy they warn the officer, who retires to the train, and the whole move to the rear.

To guard against mines such as have been recommended, to explode only under a certain heavy pressure, great precautions are needed. First the line should be inspected by parties on foot, then the mines must be exploded by passing heavy wagons over them pushed forward by a locomotive with a certain number of empty wagons placed between the head of the train and the engine in rear. It is recommended to test in this way all lines used in the enemy's country every morning before allowing the daily service to commence.

Guard and Defence of Railways.

An active enemy will undertake enterprises against a railway line used as a principal line of communications. Serious steps must therefore

be taken to guard against these by occupying and guarding the most important works, organizing flying columns, keeping at hand reconstruction trains, and using largely of cavalry patrols.

The attack of a railway will be generally confided to special parties of cavalry and light artillery, sent round the enemy's rear, and assumes the character of a raid, the success of the operation depending mainly on the spirit of enterprise and sagacity of the leader.

The guarding of a railway line cannot extend further than to the occupation of the most important points, such as stations, intersections, curves, bridges, viaducts, tunnels, and other special works, the destruction of which would delay for a considerable time the working of a portion of the line. If we consider that a single man exploding a very small quantity of dynamite under a rail can cause destruction enough to the line as will entirely stop the traffic over a certain portion of it until the damage is repaired, we shall be convinced of how utterly impossible it will be to secure at all times the line from local destructions on a length which extends over some hundreds of miles. It will be practically sufficient, therefore, to guard the principal engineering works and important places, and to keep gangs of men at the principal stations ready with all the necessary materials to despatch without delay to any damaged point of the line.

It will be as unprofitable to try and guard a line of rail in its entire length as it is a continuous extended line of field-works. By occupying the most important points and works in strength the rest of the troops are available to go about to any threatened part of the line.

The use of railways as lines of supply has so far altered the conditions of things, that now it is the line that is guarded, and not the convoys, as was the case in former times.

The damage an enemy can do to railways can be divided under three heads:—1st, destruction of bridges, tunnels, viaducts and other great engineering works, requiring many days to repair; 2nd, the destruction of smaller works which regularly organized parties of workmen can repair in about two days; 3rd, smaller damage still which will only interrupt the traffic for 24 hours or less. The most serious destruction on a railway line will be the blowing in of an important tunnel where it is impossible to construct a temporary road dispensing with the use of the tunnel for a time. The Germans, in 1870, were employed one month in clearing the tunnel of Montmédy, and the tunnel of Nanteuil gave them even more trouble. For four weeks they endeavoured to repair it, at last it became evident that no temporary repairs could be depended on, and a line turning the obstacle had to be made; this was not completed under 23 days: the tunnel of Montmédy was not only blown in at both extremities, but the interior had been blocked up with eleven over-turned engines and a large quantity of every description of materials. The destruction of a railroad running along the face of a precipitous hill will also be a serious damage. The closer to the field army the destruction of the work is effected the more serious it will be. It is useless, however, to calculate on the damage that will be caused to an enemy by the destruction of bridges, viaducts &c.; because the art of repairing these works has been pushed very far. In the American War of Secession the construction of bridges attained a great perfection; the communications were re-established as soon as they were broken. The Quartermaster General of the United States Army in his Report of 1865, says:—"Trains loaded with timber, with iron, with water and fuel for the engines, preceded the trains of subsistence and ammunition, and scarce was the communication broken before it was re-established." It should be borne in mind that this passage related

principally to the Atlanta operations, where the railways were everywhere exposed to the raids of an enterprising enemy, favoured by thick forests which bordered the railroads throughout nearly the whole length.

In view to meet any sudden stoppage of traffic on the line close to the field army it will be prudent to provide against it by bringing up to the most advanced dépôt a larger quantity of supplies than is actually needed, so as to be able to dispense with the services of the line for a few days in case of interruption of traffic in rear, however caused; also to pay greater attention to the safety of that portion of the line which lies between the field army and its nearest magazine. The small detachments guarding the line of communications can effect very little in the case of a cavalry raid as effected by Stuart round McClellan's army in front of Richmond in June, 1862, or like the second one in rear of Pope's army at Catlett's station on the Orange and Alexandria railroad on the 22nd August of the same year. This last proved very disastrous for the Federal army, for all the private and official papers of the Federal Commander having fallen into Stuart's hands, from the information thus gained were directed the operations which culminated in Pope's defeat at Manassas. Though in these and other raids of the kind, the line of communications was destroyed and great damage was inflicted on the enemy, still the position of the raiders themselves was very dangerous; they had very soon to withdraw, and the damage done was only of a temporary nature. It should be noticed that the line was generally attacked a long way in rear of the field army, and, with the nearest magazine well stocked, the army could well afford the few days necessary to re-establish the communications.

The principal points that require guarding are stations, bridges, viaducts, curves, cuttings, and tunnels. The stations, according to their importance and size, should be divided into classes. Termini stations and others where there are large dépôts of fuel, stores, and railway materials, where the principal workshops and laboratories are, or where the main lines branch off, should be regarded as first class. Watering and coaling stations, or those with sidings and small branch lines, as second class. Stations in towns and important villages as third class. Lastly, isolated stations in the neighbourhood of towns, villages, or roads as fourth class.

The most important works such as bridges, viaducts, cuttings, curves, tunnels, &c., should likewise be classed according to their importance and position, to the more or less obstruction to the working of the line their destruction would cause, to the difficulty of repairing them, and to their distance from dépôts, workshops, &c. This classing of stations and works according to their importance is recommended to assist in determining the strength of the garrison required for their protection.

About three men per mile will be required for the defence of stations and works, including 10 per cent. to meet casualties caused by sickness. In guarding railways, isolated sentries are of no use; scouts, constant cavalry patrolling along the line, good signalling stations, and flying columns, will be far more effective. In the neighbourhood of important works the destruction of which it is most necessary to prevent, means for conveying reinforcements in wagons or other available description of transport should be kept ready.

As a rule, a large portion of railway officials, *employées*, mechanics, and workmen reside at the principal stations; in their own country they should be called upon to assist the garrison in the defence of their post, for which purpose they should be armed, and, if time permits, trained in the use of their arms. The garrison for the four classes of

stations and works may be put down at about 120 men for the 1st class, 50 for those of the second, 25 for those of the third, and 15 for those of the fourth. The garrison for long bridges and viaducts should be divided into two portions, one stationed at each end of the work. Special parties should be detailed to watch curves, particularly those running between high banks, as their destruction will seriously interfere with the working of the line, and the repairs will take a long time. Many of the fourth class stations may be left unguarded, only such being occupied as will form good connecting posts.

The men of each post should patrol the line up and down to points halfway between their station and the next, and should be aided by railway police or guards. In disturbed districts parties of soldiers would have to be distributed along the track with sentries at regular intervals, some cavalry being attached to each post. A visiting patrol should be sent out from each station at daybreak to ascertain if the line has been injured during the night. Constant patrolling is recommended as the best means for ascertaining what is actually going on. A sentry's post can be easily ascertained by the enemy, but flying sentries or patrols are always on the move, their whereabouts are uncertain and the enemy is disconcerted, it is besides less fatiguing for the men.

Whatever arrangements are made, they cannot be considered complete unless a body of troops is kept in reserve at the principal stations to proceed rapidly to the assistance of any post which is attacked. Cavalry in small detachments should be detailed for the purpose of patrolling alongside the line, and whenever the telegraph wire is cut, to convey rapid information from station to station.

The Germans in the War of 1870-71 had a detachment at each railway station; from this, small parties were posted in the towns and villages in the close neighbourhood of the line. Posts were also established at every three or four miles on the railway between which the line was constantly patrolled. They, however, so thoroughly recognized the insufficiency of these means that they called others to their aid; thus, for example, every train carried on the engine an influential man of the part of the country traversed. It is related how, on one occasion, when no influential person was ready to come forward, Monseigneur Landriot, the Archbishop of Rheims, volunteered to ride as a hostage on a locomotive. Besides the above precautions, the inhabitants were held responsible for any damage done to the line in the neighbourhood of their towns or villages, and were unmercifully punished if any was done.

The village of Fontenoy was burnt by the Germans for having harboured the men who blew up the bridge of Fontenoy-sur-Moselle, and for that deed the province of Lorraine was fined 10,000,000 francs. Similar punishment was threatened for any other offence of the kind.

The reason why attempts at injuring the line, which can be so easily done, are rare, is explained by the fact that few men will run the certain risk of being shot for causing what they well know to be after all but a very temporary destruction. Where a whole community is made answerable for the actions of every man appertaining to it, the people themselves will naturally endeavour to prevent any attempt at interference with the line, which would be sure to bring on them an unmerited punishment.

The following orders were issued by General McDowell for the guarding of the military railroads in the department of the Rappahannock during the American War:—

- 1st. Twelve sentries along the track to each mile.
- 2nd. Three sentinels to each post with two hours' reliefs. Boards with number of post put up.

- 3rd. Block-houses to be erected at intervals, and at the intersection of roads. Bushes and trees cut away.
- 4th. Each post to be supplied with a red and white flag, and a lantern for signalling.
- 5th. Additional precautions to be taken at the bridges. At least one block-house to be constructed at each bridge, and guards to be told off both to watch and defend the bridges and to help in their repairs.
- 6th. Block-houses will be required at points where important roads lead to or cross the line; at such points pickets should be thrown forward, and cavalry pickets and scouts thrown out well to the front.

In preparing the arrangements for the protection and defence of a railway line, the line should be studied as if the intention was to attack it. The principal works which, if destroyed, would most seriously affect the traffic on the line and delay its working, should be ascertained, and should afterwards be guarded by a force sufficient in itself to prevent their destruction. The removal of a few rails or the destruction of a small bridge demand as much time to execute as to repair, and are not of great importance; with proper arrangements and vigilance no important destruction is to be apprehended. Reconstruction trains with the necessary *personnel* and *matériel* should be kept ready at the principal stations to proceed at any moment to any part of the line which is reported to be seriously damaged. Better to fix the locality where these repairs are needed all stations, bridges, tunnels, viaducts, level crossings, &c., should be numbered in consecutive order. The same arrangement might be extended with advantage to the telegraph lines, each post bearing the number of the mile it is in, and a consecutive number in that mile.

Preparing a railway line for defence is principally the work of the engineer companies belonging to the line of communications. Strong barrier gates should close each end of a station, bridge, or viaduct; block-houses should be erected to protect small bridges, cuttings, curves, and cross roads. Iron block-houses in pieces, raised on iron pillars, can be easily and quickly put together where most required. Each one should be provided with provisions, water, fuel, ammunition, and signalling implements; the floor being loop-holed so as to obtain a fire on the supporting pillars, and access to the interior to be obtained by means of a rope ladder. Old sleepers, rails, and carriages come in very handy to strengthen a post.

The ground round every station or post should be cleared of bushes, walls, and banks; all out-buildings, water-towers, &c., should be included within the zone of defence. These last are generally too much scattered, and, being built for the convenience of sidings, do not easily lend themselves for purposes of defence; however, they must be occupied so as to keep an assailant out of them. Both ends of long bridges and viaducts should be covered by a *tête de pont* and, as these works are generally approached by an embankment, the sides of the embankment should be enclosed within the work. To prevent the piers being mined and blown up, arrangements should be made to obtain a musketry fire on to their base. Tunnels should be provided at both ends with strong loopholed barrier gates, which can be closed by the guard on the approach of an enemy. In cuttings block-houses should be erected across the line, the trains passing under them. The portion of the cutting on a level with the block-house must be scarped to prevent an assailant firing into the loopholes.

It takes the same time almost to destroy a large as a small bridge, so that with the same labour the large ones will be attacked in

preference. As to produce a serious obstruction a large gap is necessary, the re-establishment of the line will extend principally to the construction or repairs of bridges and viaducts: the small engineering works are only likely to be destroyed when time is wanting, and a sudden dash is to be made. The difficulties of a reparation augment rapidly with the importance of the engineering work destroyed, and it is generally the want of suitable materials that makes the repairs so long and difficult, hence the formation of dépôts of materials become very necessary. With regard to bridges it will be a judicious arrangement to provide against any damage likely to be done to them by storing suitable materials for their repair, or still better bridges of various spans, in some convenient station, to forward at once so as to replace any that have been destroyed.

Whatever arrangements are made for the protection of the line the garrison of the various posts should have means for communicating with each other and passing information rapidly from post to post; this is very necessary to receive assistance from the reserves kept ready to proceed to any threatened part. Where the posts are far apart, each one should be provided with a good field-glass to be able better to observe what takes place on the line and in the neighbourhood of the post.

Jacquin, in his interesting account on the railways in the War of 1870-71, remarks that the experience of the last wars has demonstrated that, once a railway line is occupied by the enemy, all hope of resistance seems lost, and nothing is left but to submit to the conqueror. In other words that a line efficiently guarded will defy all attempts made against it.

A simple contrivance is used by the salt patrol in India to ascertain if during the night any person has crossed the fence which is maintained to prevent the smuggling of salt. At dusk every evening a bush is drawn along the ground on one side of the fence from post to post, the parallel lines left on the ground by the passing of this bush are carefully examined in the morning, and any footsteps are easily detected. The same plan might be adopted in guarding railways, carefully examining in the morning any part of the line which has been found to have been crossed during the night.

Destruction of Railways.

Railways, in war, are destroyed either to deprive an enemy of the advantages he may derive from their use, or to encumber and delay him. The necessity for destroying a railway can principally arise in two cases, either when an army is retiring, to stay the pursuit, or in a defensive war to deprive the invader of a means of transport on which he may have counted. The destruction of a railway on one's own soil, as would be in the latter case, demands great prudence, as the damage would fall on one's own people. The destruction can be either limited to the rails, sleepers, points, &c., or extend to the permanent way, including the demolition of large engineering works. If it is only intended to deny the use of a railway temporarily to the enemy, destroying the line will be sufficient; but where all probability of being able to use it again in a short time has ceased, and where the enemy can benefit largely by its use, the permanent way should be destroyed; the preference in the demolitions being given to all those works and parts of the line which present the greatest technical difficulties. All premature destruction should be avoided; it should always be remembered that the first duty is to guard and defend these expensive roads, and

that their destruction, whilst provided for in peace time, is one of those stern measures that should be only adopted as a last resource.

It will be useless to destroy anything but what will seriously affect the traffic, and the means for destroying railways, now that it is understood to what use they can be put to in war, should be studied at the time of their construction. The destruction of large engineering works, bridges, viaducts, tunnels, &c., ought never to be undertaken unless a pressing necessity makes their destruction imperative. In 1866 the costly railway bridge at Reisa was burnt by the Saxon Army without gaining any military advantage thereby. The Saxon Army was retiring into Bohemia, all that was hoped for by the destruction was to gain a few hours over the advancing Prussians, an object which might have been equally well attained by the removal of a few hundred yards of rails. As it was the Prussian advanced guard occupied Reisa in the night, and the restoration of the bridge, at the expense of the country, was at once ordered. In three days the circulation was restored. This destruction, as causing a considerable loss without any corresponding compensation in a military point of view, has been condemned by several military writers of great authority. On the 22nd July, 1870, the Germans blew up a portion of the bridge at Kehl, over the Rhine, another unnecessary destruction, considering that the French had no large body of troops then to send across the river.

The destruction of railways applies to those in one's own territory as well as to those of the enemy. Those of the enemy should be attacked from the very commencement of a campaign by small parties, principally of cavalry. The damage these small parties can do is generally very small, but at times even the destruction caused by a small party may interrupt the traffic for a few hours, if not for some days. The destruction of our own should be carefully studied and prepared for, however confident we may be in our strength, as it will be as well in case of a reverse to have everything prepared. Thus, for example, the preparation of chambers for mines in bridges, tunnels, and viaducts, particularly on strategical lines, which is often practised on the continent at the time these works are constructed, cannot be too highly commended. When the line is taken up only as a temporary measure, the rails should be removed from those sections only where the road runs in a straight line; the curves should be left untouched.

Both for temporary and for lasting destructions trained men will obtain better results, and in a shorter time than if troops inexperienced in the work are used. The first would go without any hesitation, with a few men direct to the essential points; the latter would employ too many hands and precious time in removing rails, burning rolling-stock, &c.; one party would employ half-an-hour, the other several consecutive hours, and, should a lucky change restore the line into their hands, the useless destruction and ill-judged work will demand long, difficult, and costly reparations. The choice of the principal works to be destroyed, and the most effective means to be employed in their demolition, should form matter for an inquiry during peace time. Instead of preparing beforehand the destruction of all works indiscriminately, it should be ascertained which are the ones which would principally render a line impracticable for a long time, and those which must be inevitably destroyed in cases of retreat.

Before ordering the destruction of any important work which would demand much time and money to restore, it should be well considered:—1st, if the destruction is absolutely necessary; 2nd, if the work is of no further use to us, and if every hope of requiring it again soon is gone; 3rd, if the advantages to be derived from its destruction are a sufficient compensation for the damage done.

Whenever a destruction of trifling importance will suffice, it is wanton to order the destruction of large engineering works, but, when the eventualities of the war demand the latter, no hesitation should be allowed to interfere, and even the complete destruction of an entire line should be undertaken. The works situated close to a strategical point, or any that may facilitate the passage of large masses of the enemy, demand particular attention.

As the destruction of a railway line will be carried out by the railway corps, it is unnecessary to enter into details as regards its execution. The railway corps will carry it out in conformity with the principles they have been taught during their training in peace time, and under the direction of capable engineers fully acquainted with what requires to be done. The demolitions must be carried out without fear of being disturbed by the enemy. The removal of the rolling-stock is the first thing to do, and this can be done more effectively if the enemy has no line adjoining one's own, or if his line is constructed on a different gauge. It is often recommended to render the rolling-stock useless by destroying or removing some important parts; this, however, can only be looked upon as a temporary and a hurried measure, for the enemy will soon obtain the missing pieces: the removal to a distance or complete destruction of it can only be considered as effective measures. If it be impossible to remove it, or the time to abstract those parts that will render it unavailable for use be wanting, it should be burnt. The *personnel* might be requisitioned by the enemy to work an abandoned line, to provide against this it should be, when possible removed to a distance and taken out of reach.

McClellan, foiled in his attacks on Richmond, retired; having not sufficient time to embark his rolling-stock, and fearing that burning it would attract the enemy's attention, he directed it at full speed over a broken bridge into the Chikaominy. The Americans precipitated their trains going at full speed into a river or over a broken viaduct, at other times they loaded their trains with ammunition and combustibles, and sent them against each other, the shock caused an explosion, and the fire destroyed all. Thus they denied the use of their rolling-stock to the enemy.

The destruction of the line itself is useless, unless the *matériel* is removed or destroyed; if it is deficient and cannot be replaced by the enemy, the traffic will be stopped for a long time: the removal of the rails on a large extent of the line will be always effective. If the rails cannot be removed, and a river or lake is at hand, they can be thrown into either of these. The Americans burnt the sleepers and bent and twisted the rails, but even this last measure was of little avail, for they soon made machinery for restoring them to their original state. Destructions effected at the junctions of two lines are important, as they may compel the enemy to undertake inconvenient detours.

The destruction caused to small bridges, viaducts, &c., is not of great consequence for these are easily repaired; the large ones, therefore, should be demolished in preference. The vaults of important tunnels, above all, should be blown in, for no demolition will so severely embarrass the enemy as this. The destruction of the tunnels of Nanteuil and Montmédy during the last Franco-German War are good examples of how injurious to the continuous traffic of a line the demolitions of tunnels are, and we can well imagine the joy of the Germans when they found the tunnels under the Vosges untouched. As a rule, all lines which the enemy can use for communications, and which cross a defile not otherwise to be diverted, should be destroyed at these points, and no hesitation should be felt here in destroying an important

engineering work. The filling up of cuttings with *débris* by blowing in a retaining wall, rocks, &c., to be at all effective, must be done on a large scale; then only it can take a long time to clear the roadway: the removal of the encumbering mass being only possible at the two extremities, considerable time will be employed in clearing the roadway.

Small mounted parties can do serious injury to the enemy's lines, particularly when these run parallel with respect to the front of their own army, but the destruction can only be of a temporary nature: these parties will seldom have sufficient means with them to attack large masonry works. Wooden bridges are more at their mercy, and can either be burnt, or be made impassable for a train, by sawing a few of the principal beams. In the American War wooden bridges were covered with fascines over which some casks of pitch or petroleum were poured; once the fire was lighted the bridge was soon destroyed.

In attacking the enemy's railways, the troops employed must be furnished with proper tools, powder, dynamite, &c.; and the better to withdraw attention from the place selected for attack, diversions should take place at other points. Ripping up railway is a difficult work for troops unaccustomed to it, but people experienced in it find no difficulty whatever in the work. In hilly and wooded countries the destruction will be much easier. In destroying a double line, the re-establishment of a single line should be made impossible: all the pieces which are used to transfer the carriages from one pair of rails to the other should be removed. The destruction of all that is necessary to keep engine going should be attended to in these raids.

The engines unable to obtain water or fuel become useless as means of traction, and a railway without locomotives is not of the slightest use. All materials, rolling-stock, fuel, means of supply, that cannot be removed should be burnt. When a station is well defended, and the attacking party too small to carry the post, to destroy the line on both sides of it will affect the traffic, particularly in the case of an important station.

Attacking the trains in place of the works has been advocated by some writers as a more effective way of inconveniencing the enemy. If the trains are blown up and thrown off the line the drivers become timid and cautious; transit becomes slow, for the line has to be tested before moving a heavy train, and the speed is thus very much reduced. It is impossible to guard the entire line, a small explosion, for example, a shell, will throw the train off the line; the train itself will explode the shell as it passes over it.

Again the direction of the rails may be altered, so as to force a train off the line. For this a spot should be chosen either on an embankment or in a cutting; in the first the train will be precipitated down the embankment, in the second it will be dashed against the side of the cutting. To do this, the fish-plates should be undone and the ballast taken up, then with levers the head of the disjointed line should be turned either to the right or left, taking care to maintain the same gauge, so that the engine may easily turn in the desired direction. Altering the gauge will also cause a train to quit the line; to do this the ballast must be taken up and a dozen sleepers sawn across, or even burnt, after which there will be no difficulty in increasing the width of the gauge.

Mines have been advocated to be exploded only by the passage of heavy trains. The slight interval left between the heads of two consecutive rails has been proposed as the means for exploding these land torpedoes, either by making use of the concussion caused on the extremity of a rail, when a heavy wagon passes over it, or by the

wheel re-establishing a current of electricity, which is broken by the interval existing between two contiguous rails.

The moral effect that mines produce on the mind of all soldiers is known to be very great, and there is no doubt that it will be equally damaging when these are used in railways, hence great measures of precaution will be needed. Fortunately, these mines demand time to lay down, and in a carefully guarded railway will seldom be attempted.

We borrow, as an example of a train destroyed by a land torpedo or mine, the following account of one exploded at Lannois in 1870, contributed to the Professional Papers of the Corps of Royal Engineers for 1872, by Lieut. T. Fraser, R.E. :—

"The following account of the demolition of a railway train was obtained at Lannois, from a sub-officer of a company of Franc-Tireurs, known as the Franc-Tireurs of the Meuse, who were engaged in the work :—

"They had ascertained that a Prussian military train was to pass by Lannois (on the line between Rheims and Mons, on the 26th October), and they determined to destroy it. As an obstacle on the line would probably have been discovered, it was decided to use gunpowder, lodged in the permanent way, to be exploded by the passage of the engine. A spot was selected where a well wooded slope ran down to a cutting on the side of the railway, while on the other side (that along which the train was to pass) was an embankment of perhaps 12 feet in height. The woods on the upper slope communicated with large woods which provided a safe retreat for the Franc-Tireurs.

"A pair of rails were taken up, the sleepers removed, and a deep trench cut across the ballast of the outer line. Some pieces of iron were laid on the bottom of the trench, and on them a box was placed, containing 30 kilos. of powder. A percussion fuze from a French shell was fixed into the lid of the box, so that when one rail was replaced, the head of the fuze was just below its lower flange.

"In replacing the sleepers and rails, one sleeper was left out, so that the rails were unsupported for a length of about two metres over the powder box ; the ballast was then replaced, and nothing was left to attract attention.

"The Franc-Tireurs, about 75 strong, were then posted in the wood beside the line.

"In due time the train came up at the ordinary speed ; it is said to have consisted of about 40 carriages, with a number of German soldiers in them. As the engine passed over the rail, it forced it down with a blow on to the fuze head ; the iron under the box prevented any yielding, and the fuze exploded and fired the powder.

"The explosion tore up a connected mass of rails and sleepers, and at the same time threw the engine down the embankment, where it was followed by some of the carriages. The whole train became a wreck, and the confusion was increased by an explosion of steam in the engine. Those soldiers who were able to clear themselves from the wreck were shot down by the Franc-Tireurs from their cover. In this way they claim to have destroyed above 400 men. They believe that a few escaped by passing back along the line.

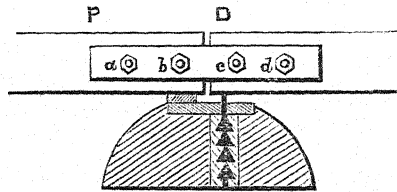
"The remains of some of the carriages were still lying at the foot of the embankment as I passed the spot."

The following description will convey some idea of the principles upon which a Prussian officer, W. Basson, in his clever work on railways, recommends the explosion of one of these land torpedoes, fougasse, friction mines, or whatever name we may wish to give them :—

"The most effective way to prevent the enemy re-establishing the circulation consists in annoying him, and placing him in peril during his work of reconstruction.

"After having had a line reconnoitred, and having re-established the damaged parts, an enemy has the road tested by a trolley, it is only after this that the locomotives can circulate. If some mines are prepared in the permanent way to burst under a certain pressure, the trains will be easily destroyed; to do this, it is necessary that these mines should not explode when a light carriage passes over them, but only on the passage of a locomotive. The enemy is continually harassed in his transit service, the line is destroyed, the carriages are broken, the servants, always on the alert, advance trembling, examining with the greatest precaution every rail, every fish plate, the enemy loses time, which after all is all that is asked for.

"These means of destruction, which we shall call friction mines, have not yet been employed, notwithstanding one can predict a great success for them. I will therefore develop this idea by giving a few details.



"Any one watching a rail at the moment when a train passes perceives that at every joint the wheels undergo a shock, and this is the reason of it: between every two consecutive rails there is a space of two and a half lines necessary to allow for expansion; for the same purpose the holes *a, b, c, d* bored in the rails are oval, whilst those in the fish plates are round.

"On a wagon arriving at *P*, the rail on which the wheel rests sinks, the wheel rises at *D*, and a shock is felt at this point.

"The force of the shock against the end of the rail is further increased by placing under one joint a plug a quarter of an inch thick, as shown in the figure. In this way one extremity of the rail is supported, whilst the one that receives the shock is *en l'air*.

"It is plain that the passage of a light carriage will not lower the rail, which by reason of its rigidity will resist the weight of this carriage." We need not follow the writer any further in his description of how the fuze is set and other particulars, the above details are sufficient to show on what principles the mines he proposes rest. Whether his ideas will be considered worthy of being carried into effect or not remains to be seen, but that it is easy to interrupt the traffic by some means of this kind there can be no doubt.

As an enemy now generally takes the precaution of testing for these friction mines, and trains pushed by locomotives in rear are sent to explode them before the daily traffic is allowed to commence, means must be taken to prevent the friction or percussion fuze acting until after such a reconnaissance has been effected.

Dynamite is a very powerful agent in the destruction of railways; it is easily carried, and its breaking force is eight times that of an ordinary mine. Its action is very rapid and local, it produces little troublesome smoke, and does not require to find much resistance. Iron bridges can be easily destroyed by this terrible agent; a thick hose containing dynamite, in the same way as employed in felling

trees, is fastened round an arch or a girder and exploded. A charge of dynamite placed over the vault of a railway bridge, and covered with a little ballast will be enough to destroy the arch.

Some years since, during a course of field works at Chatham, some instruction was given to show the effect of this powerful agent in demolitions. A short railway was attacked, the ground under the fish plates joining two consecutive rails was scraped up and the charge (2 lbs. 12 ozs. of dynamite) introduced; a little rubbish, and a hurdle which was found close at hand, was placed on the top of all. The explosion put the line completely out of order for traffic, the rails were bent in on one side and driven apart on the other, several of the sleepers were displaced, some of the chairs broken and others loosened; the rail over the charge was broken and bent up, and a piece about $1\frac{1}{2}$ feet long was found over 300 yards from the place where the experiment was carried out. All this damage was done with a piece of dynamite about the size of one of Kopf's consolidated pea soup tins, showing what advantages can be derived by the use of this powerful agent when only a few men are available to attack a railway, or when the employment of a large body of men is undesirable, so as not to attract attention: a couple of horsemen who can easily subtract themselves from view can effect a temporary destruction of this kind.

Time Tables.

It has already been remarked that the ordinary railway time tables must give way to special tables when a railway line is for a number of consecutive days entirely taken up for the transport of a large body of troops. The preparation of these tables will principally occupy the attention of the technical director, but, as the military railway officers will often have to help in this work, it is necessary that they should acquire some knowledge in their preparation. The graphic time tables which have been employed in foreign railways for some years are particularly applicable to the movement of troops, showing as they do at any time of the day where the smallest fraction of the troops are. These tables are so prepared as to show at a glance the whole movement over a line, backwards and forwards, during the twenty-four hours. They mark the principal stations along the line, the hours at which trains are to start from each of these, and the hour of arrival of each train at the detraining terminus. The description of troops, stores, supplies, ammunition, &c., each train conveys are thereon shown by the use of conventional continuous or dotted lines. A dark tint is generally used to distinguish the night from the day service, and the return trains are easily ascertained, being marked by a line of a different colour. Halts made at particular stations are shown by short horizontal lines, and their duration, as well as the time where trains overtake each other, or, if coming from opposite directions, pass each other, are marked in small numbers at the points where these occur, to show the precise time when such take place. On single lines the trains can only pass each other at a station, or double lines on any part of the line. It is almost unnecessary to remark that, to prevent accidents, a uniform time must be kept along a railway line, independent entirely of the correct local time; this applies principally to those lines which run from East to West or *vice versa*. The railway graphic tables are often very complicated, and contain much matter which is superfluous for the military officer. In the preparation of time tables for military movements, the information needed, besides that specified above, is the position of the watering,

engine-changing, and crossing stations, which can be easily marked by conventional signs. The conventional signs denoting the description of troops in each train will convey to the officers superintending the detrainment, or the alimentation of the troops in transit, the necessary information for receiving, or for providing for each special arm.

On the graphic tables used by railway companies, the line of march of a train is shown as a broken line, to denote the actual speed attained by the train moving on various parts of the line. This will render the tables more valuable, as it will show the precise moment each train will pass or cross a given point; but practice alone can render people conversant with these apparently very complicated tables. Graphic time tables are admirably suited to replace figure tables in railway work; they have the advantage of showing at a glance what special trains can be added to those already fixed, without fear of accidents; the drivers and guards in cases of accident can see clearly their position, and when the following train can be expected on any part of the line; and the rail-road engineer will easily discern when a line, being unoccupied for a time, can best be delivered over for repairs. They were much used during the war of 1870-71, printed on paper, and for out-door use on slightly glazed cloth.

The graphic time tables are divided into two parts; on the left hand side they contain the name of the departure stations, number of trains to start from each, distance of each station from terminal station, duration of time in transit, and stoppages. As stations vary in importance a different type is used to denote the importance and nature of each one. On the right hand side are shown the hours of departure of the trains from each station, the time they pass through intermediate stations, and their final arrival at the terminal station.

The right hand side is composed of vertical, horizontal, and diagonal lines in which the vertical lines show the division of the day into hours or half-hours, according to the interval fixed between two successive trains; the horizontal lines represent the points of departure and of passage, and the diagonals mark the time occupied by the different trains in transit.

These tables above all tend to show the hour of arrival of the military trains at the terminal station, which is represented by a line at the top of the table, divided into hours or half-hours; where the diagonal lines terminate into these indicates the hour of arrival of each train in succession. What is of the greatest importance is to ascertain the nature and probable time of arrival of each train at the terminal station: here all trains come, and everybody gets out, which will not be the case at any of the intermediate stations, where the train as a unit is under control; at the terminal station the detrainment, forming up, unloading and reloading of carts, issue of orders and directions, removing of empty rolling-stock, &c., will lead to a certain amount of unavoidable confusion, unless the arrangements and preparations are very complete, therefore very precise information of all trains about to arrive must be obtained and this the graphic time tables fully convey.

Our space does not permit us to do more than simply to allude to these time tables for military movements. Their compilation demands an intimate knowledge of all the rules which regulate the ordinary railway traffic, and this can only be acquired by a study of such works as deal fully with the subject. The Military Student will find this question dealt with in a succinct form in the following book: *Guide pour la préparation des transports de troupes par les chemins de fer en temps de guerre.*—Par A. Le Pippre, Chef d'escadron d'Etat-Major.

Pioneer Railways.

We have not yet made the most of railways for wars in barren and uncivilized countries, and that it may be found possible to use makeshift railways, as a means, principally, to reduce the difficulties of transport in future, we have no doubt. With the many difficulties to contend with in laying down a railway, a long time is necessary to complete but a few miles of road even in those countries where skilled labour is abundant; but, where this is insufficient or totally wanting, and where the engineers and overseers have besides to instruct and direct the little that can be found in a strange tongue, the difficulties immensely increase. The time available in our wars being very limited, and skilled labour quite inadequate, what is required for military purposes in these countries is a light temporary line, entirely prepared out of the country, capable of being quickly laid down by comparatively unpractised hands, and of being worked with light engines and light wagons.

Generally speaking, a light railway line is here required for no great length of time, and which must be constructed so as to permit of the wagons ascending moderate gradients, by some mechanical levelling, as time will be generally wanting for anything more. Heavy solid carriages are not needed, but, on the contrary, light ones, principally to convey provisions, and to transport sick and wounded men. This auxiliary is not required for the troops, for the troops can march; it is principally needed to economize animal transport, but even if used for the transport of troops, any rough and ready accommodation would be sufficient, for the journeys would not be of any great length.

As the *matériel* of a temporary railway can be taken up when no longer needed and stored for future use or sold, we have no doubt that, though the first outlay may appear great, in the end it will be found far more economical than the expense generally incurred in the purchase of a large quantity of transport animals, equipment, and *matériel*; their transport by sea to the seat of war; the forage, pay, feeding, and clothing of thousands of drivers; the losses from hard work and insufficient forage; and ultimately the heavy loss to Government on the breaking up of the transport at the conclusion of the war.

In the Ashantee Expedition, 30 miles of railway plant formed part of the war materials sent out to the Gold Coast, but it soon became apparent what difficulties there were in laying down a line constructed on ordinary principles: the work was never attempted, and the plant was returned to England. Little difficulty, however, would have been found in laying down a light post and rail railway, and considering the difficulty of obtaining transport, no doubt can exist that some makeshift railway of this kind might have rendered signal assistance to the expeditionary force.

The late Mr. J. L. Haddan's pioneer railway* seems to fulfil the main requirements of a rapidly constructed economical railway for military purposes. The whole of the *matériel* can be prepared at home and forwarded to a distance, ready to be put up at the rate of a mile per day for every hundred men employed. The pioneer railway is a post and rail line, the engine working above the level of the ground; 440 posts are required for each mile, sunk into pits in the ground, and these can be easily dug by the most unskilled hands. Thus the

* See "The Pioneer or Steam Caravan," by J. L. Haddan; printed by William Clowes and Sons, 1878.

railway corps would only have to superintend the fixing, bolting, and levelling of the line, the labour of the country being utilized for the rest of the work, should the employment of the troops in this not make us independent even of all foreign aid. An engine of 100-horse power, weighing 4 tons, is employed, and is of sufficient power to draw a load of 100 tons over a hill-side with gradients of 1 in 10. The line can be constructed of iron or timber; the latter is cheaper, and damages or omissions are more easily repaired than where the former material is used, though liable to be destroyed by fire; with an iron one the people of the country would not as a rule have proper instruments to effect its destruction.

For the small number of effectives we employ in such countries, 100 tons is a good weight to carry in one trip, for it represents 125 cart loads, at 16 cwt. per load, or 1,120 loads, of 200 lbs. each, for animals of burden. When we come to consider that with the ordinary transport these loads would have to be carried for many consecutive marches, whereas the railway could accomplish several trips in one day, the saving over the usual transport will be readily acknowledged. It should be recollected that speed is not so much required as a continuous movement; to push forward supplies steadily without a check is what is principally required. If it be objected that laying down the railway would delay the advance, we can reply that in these wild regions the difficulties of transport and having to forward everything from the base make the advance anything but rapid; on the contrary, it is generally very slow, for it takes time to bring forward and collect stores and supplies, and the troops are delayed road-making and preparing the roads for the transport, a slow process at the best of times.

The use of a pioneer railway would reduce the number of communication stations, magazines, dépôts, &c., all points which conduce to a saving in the expenditure; would make the camps more compact, for it is principally the presence of a large quantity of transport animals, carriages, &c., that swells the size of an encampment; there would be no lengthy convoys to guard on the roads, and the ignorance of the natives might be turned to account, and might keep them from interfering with this dreaded mysterious monster.

Before quitting this subject, let us examine the cost of the line. Mr. Haddan's estimate for an iron line is 960*l.* per mile, delivered at Liverpool; to this should be added the cost of the rolling-stock, freight, and (if military labour is not employed) of the men employed to put it up and work it. A timber railway, again, is much cheaper; the cost of the line itself being estimated at 785*l.* per mile when an iron rail is used, or as low even as 560*l.* without it. In an estimate for an iron line from the Mediterranean to Aleppo, a distance of 104 miles, which we might take to represent a line from a sea base to an objective point in the interior of an invaded country, the cost is estimated at 150,000*l.* This, no doubt, would appear a very heavy item of military expenditure in preparing for an expedition, but against it must be set the reduction in point of time of the operations, for, as the advance will be ever so much more rapid, in the same proportion the duration of an expedition would be shortened. The cost of a transport corps, say, for 12,000 men, complete in everything, on a line of the above length, in an unproductive country where every ounce of food has to be carried from the base, will greatly surpass the above sum. For the sake of argument, let us suppose that there had been no obstacles of country to militate against the employment of a pioneer railway in our Abyssinian Expedition, the cost of such a railway for 380 miles at 1,000*l.* per mile would have represented 380,000*l.*, but

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what did the 41,723 animals received in the transport there cost? In estimating the probable cost of a campaign, here is a known quantity to deal with, and not such a very vague one as the cost of the transport invariably turns out to be.

With regard to freight, it is calculated that 1,000 tons of shipping are required for each 10 miles, including their due proportion of rolling-stock.

Of course the question will arise, is this description of railway suitable alike for all countries in which we have to wage war? The reply to this can only be that it is not. In the China War of 1860, where the country was quite level, it would have answered extremely well; and so it would have in Ashantee, though, perhaps, there might have been some difficulty in laying it across the swamps, which might, however, have been easily overcome. In Abyssinia, on the contrary, it would have been difficult to employ it, owing to the up and down, and in parts precipitous nature of the country; we might say the same of Afghanistan, though from Sukkur to Dadur at the entrance of the Bolan Pass, a distance of about 170 miles, no more suitable country for this description of railway could be found. Like everything else, the varied nature of the countries in which we have to carry out military preparations precludes our adopting always the same means, still we should not neglect in suitable countries to adopt those improved means of communication* which science offers us, and which may facilitate greatly our operations. We cannot abstain from touching on this subject, as it concerns a considerable improvement of which a line of communication is capable, even in wild desolate countries, and nothing that may better the communications of an army should be neglected by a military administrator.

CHAPTER VI.

TRANSPORT BY SEA.

THE SEA OUR PRINCIPAL LINE OF COMMUNICATIONS—MEANS FOR DESPATCHING TROOPS BY SEA—TROOP-SHIPS—ADDITIONAL TRANSPORT FROM THE MERCANTILE MARINE NEEDED—HOW TO OBTAIN IT—NUMBER OF SHIPS REQUIRED FOR EACH ARM—AMOUNT OF SEA TRANSPORT EMPLOYED IN SOME OF OUR LATE WARS—EXTRA STAFF TO SUPERINTEND THE EMBARKATION—TONNAGE REQUIRED—PRELIMINARY SURVEY—FITTING OF SHIPS—HORSE TRANSPORTS—DESCRIPTION OF FITTINGS—STORES TO BE PROVIDED—SICKNESS AMONGST HORSES AND TRANSPORT ANIMALS AT SEA—MEDICAL AND VETERINARY ARRANGEMENTS—MEDICINES—VENTILATION—EMBARKATION OF HORSES—CLEANLINESS—STABLE DUTIES—WATER SUPPLY—EMBARKATION OF STORES—FINAL INSPECTION—ADMIRALTY AGENT—DEBARKATION.

On account of our insular position an army of ours taking the field from home has to be transported by sea to some distant foreign land. The principal line of communications with our colonies and foreign dependencies being also the sea, when hostilities threaten or a war suddenly breaks out, we are compelled at once to forward reinforcements, supplies, and stores by sea to one of these far-off places. Few officers have

* A tramway drawn by horses, if nothing better can be laid down, will be of service, even if confined to those parts which are suited to it, to relieve and economise animal transport.



an opportunity of becoming practically acquainted with the preparations necessary for despatching large bodies of troops by sea. To obtain a complete familiarity with all the points which have to be attended to in these operations, not only a certain knowledge of the troop-ship and transport regulations is necessary, but access to the reports of Special Committees, many of which are often not easy for every one to obtain; we propose, therefore, in this chapter to set before the military student in a succinct form the necessary arrangements that have to be made in military embarkations and debarkations.

A study of this subject can be divided into four distinct heads, viz.: 1st, The preparation of the troops and transports; 2nd, The necessary arrangements for carrying out an orderly and rapid embarkation; 3rd. The voyage itself; 4th. The debarkation of the troops, animals, stores, *matériel*, etc.

It is considered that by practice the operations of embarking and landing troops are to a great extent facilitated. Our army embarks and lands a large number of men every year, hence it gains a certain yearly amount of useful instruction in this service. The utmost should be made of these sea voyages, which should not be looked upon merely in the light of sending out and bringing home troops, but should be accepted as of the highest value on the point of training, and be strictly carried out with that object.

For embarkations, as for everything else in war, a well digested system should be prepared in time of peace: after mature consideration of every single point, clear rules should be laid down for the guidance of all concerned, all officers alike being made acquainted with them. The embarkation and debarkation scheme, or system, naturally requires revision from time to time, to meet the alterations which the times are sure to introduce.

Embarkations are more laborious than debarkations; in the first our attention is required to a number of details which are essentially necessary to provide for the men and animals being landed after a lengthy voyage thoroughly fit for work. Transport by sea saves the troops all the fatigues and exposures of a long march, even to a greater extent than is obtained in their transport by rail on land. The actual movement of the troops is calculated to be at least eight times as fast as they could march,

A large force demands for its conveyance by sea a much larger number of transports than are kept for the regular service of reliefs. The Government troop-ships kept up for the service of periodical reliefs between the United Kingdom, our colonies, and India are the Indian troop-ships "Crocodyl," "Euphrates," "Jumna," "Malabar," and "Serapis," each of which can carry 1,097 men and 58 horses. The Imperial transports are the "Himalaya" and "Orontes," which can accommodate 1,097 men and 58 horses each; the "Tamar," with accommodation for 1,097 men and 10 horses; and the "Assistance," for either 800 men and 8 horses, or 160 men and 138 horses. The last is principally used for the interchange of troops at home.

When a large force has to be conveyed by sea a number of ships must be obtained for this purpose from the mercantile marine of the country. These ships are generally hired for the service on monthly pay, a definite number of months being specified in the contract, at a certain rate per ton: ships may otherwise be hired for a specified voyage.

A sudden demand for shipping will be taken advantage of by shipowners, and prices will rise to a great extent where Government has no option but to hire a large number of transports without loss of time. The Government of a large maritime Power like England should

therefore be able to apply the system of requisitions to ships just as other Powers do to the land carriage, a fair rate of hire being secured to the owners by a joint committee, of which representatives of the army and navy and shipowners should be members. Acting otherwise, due regard to economy must be lost sight of. If a system of requisitioning was made applicable to shipping by Act of Parliament, no money would be expended in hiring some time before the actual outbreak of a war, and no suspicion of an intended movement would be raised through the mere fact of hiring a large number of transports. The necessities of modern warfare demand very complete preparations and rapid execution, for the favourable moment for action will be lost if we find ourselves in a state of unreadiness. In time of war commerce is more or less paralyzed, and a number of ships become idle, therefore there should be no difficulty in obtaining the number of transports we may at any moment require, but the calculation of what will be needed should have been prepared beforehand.

Large steamers are preferable to small ones, for their higher rate of speed reduces the duration of the voyage; there is greater space and therefore the *hygienic* conditions are better; a lesser number are needed, and complete units can be conveyed in each: such ships are fitted with ports and scuttles, have more room for coals, rendering coaling unnecessary for voyages of moderate length, and are, lastly, more economical in the consumption of coals. If possible none under 1,500 tons should be used.

Transports will be required more or less at the following rate:—

For a battalion of Infantry	..	..	..	..	..	1
„ regiment of cavalry	..	..	..	..	..	3
„ battery of artillery	..	..	..	..	..	1
„ company and field park Royal Engineers	..	..	..	..	..	1
„ pontoon troop	..	..	..	..	..	1
„ telegraph troop	..	..	..	..	..	1
„ transport company Commissariat and Transport Corps	..	..	..	..	..	1
„ Division	..	..	..	..	..	20
„ an Army Corps complete in everything will require about 150 ships;						
but, with regard to numbers, much depends upon the capacity of the ships employed.						

The officers of the Head-quarters Staff are generally conveyed in a special transport.

In 1854 a British expedition sailed from Varna for the Crimea (composed of 33,452 men, with 3,349 horses), in 24 steam transports, 64 sailing transports, 4 commissioned screw steamers, and 1 commissioned sailing transport. From 7 o'clock A.M. to 6 P.M. on the 14th September 30,000 infantry and 24 guns were landed at Old Fort near Eupatoria, 326 boats and 24 horse and gun flats being used for this purpose. The Cavalry and Engineers were landed after the infantry.

For the British force (about 14,000 fighting men) which, in conjunction with the French, invaded China in 1860, a fleet of about 200 vessels was employed.

The total amount of shipping employed in the Abyssinian expedition for troops and stores amounted to 75 steam transports, 205 sailing transports, and 11 purchased ships, (8 of these were tugs and barges, and the other 3 were small steamers) with a total tonnage of 304,139 tons.

In the expedition from India to Malta of 1878, the 6,127 men, 1,377 horses, 2,266 followers, and native cavalry baggage ponies, were accommodated in 28 ships; of these 12 only were steamers, and these towed the remaining 16.

The reinforcements which left England for Natal after the disaster

at Isandlwana, from the 19th February to the 1st May, 1879, comprised a total of 387 officers and 8,895 men, with 1,866 horses, 238 carriages, besides stores, ammunition, &c.; all these were conveyed in 20 steamers, several of which were of exceptionally large size.

Ships are required for the conveyance of men, troop horses, transport animals, stores, supplies, and ammunition, and must be prepared according to what they each have to convey. For stores and supplies no special preparations are needed, the articles being shipped as cargo; for ammunition and other highly combustible stores some special precautions are necessary; and for men and animals certain fittings are required. Those conveying men and animals must also be laden with provisions and forage to last the whole voyage, with a certain surplus quantity in case of accidents: in some cases, these have been even laden with a stock of supplies for the use of the troops after landing. Naturally all the available space for cargo, in excess of what is required for the troops, should be utilized, to save as much as possible the expense of chartering special vessels for supplies.

All hired ships have to be surveyed, chartered, fitted, laden, and despatched. Forms of invitations for tenders, both for shipping and stores, are kept, in which the various items regarding destination, duration of service, articles to be furnished, &c., are filled in when the invitations are issued, so as to suit the special circumstances of the case. The method generally pursued in inviting for tenders is by inserting advertisements in the local papers, all necessary particulars being specified in such notifications. The conditions necessary for the safety and well-being of the troops in hired transports require to be considered from time to time by a competent board of officers, and the regulations are frequently revised to meet any altered conditions or circumstances.

In all cases where there are various good harbours with promising shipping, and in railway communication with the troops quarters, the rapidity of the embarkation may be secured by fitting and embarking at the various ports. In the expedition to Abyssinia, ships were hired for troops both in Bombay and in Calcutta, the Bengal Brigade being embarked entirely at the latter port; for stores and coals, ships were hired also in Kurrachee, Suez, Aden, and Point de Galle. Ships may be fitted out for troops in one port, afterwards being sent round to the port of embarkation to take them on board. This was done in sending troops to India at the time of the Indian mutiny, when several large clippers were fitted at Liverpool and sent round to Portsmouth to receive the troops. In the Malta expedition a steamer and a sailing ship, after being fitted in Bombay, were despatched to Connanore to relieve the Madras troops. In the late embarkation of reinforcements for Natal transports were fitted at Liverpool, afterwards being sent round to Southampton to embark men and horses. Ships may further be surveyed and hired in one port and sent to the port of embarkation to be fitted.

At home with plenty of skilled labour, plenty of materials and proper workshops, contractors can readily come forward to undertake the fitting of ships for troops in a very short time; this is a great advantage which it must be recollected our seaport towns abroad rarely possess. In the preparations for the embarkation of the Indian Contingent for Malta in May 1878, the principal departments in Bombay, like the Dockyard, Port Trust, Public Works Department, the Municipality, &c., were all pressed to assist and secure the rapid completion of the work, one or more ships being assigned to each of the above departments to be fitted.

The arrangements for the embarkation of a large force should be

entrusted to a standing committee in which all the branches of the service should be represented: in the hands of this committee the arrangements for the whole movement should rest. The ordinary staff at the port of embarkation will not suffice to carry out the ordinary and extraordinary work that will have to be attended to, additional officers, non-commissioned officers, and writers, active, intelligent and hard-working, should therefore be employed to render assistance to the ordinary staff. In all cases where transports are engaged at various ports, each port should have officers detailed to act on surveying committees, to supervise the fitting and attend to all the details of the embarkation, all acting under instructions from the standing committee. The work should be fairly partitioned from the very commencement amongst all these to obtain the maximum of assistance and dispatch. A clear detailed plan of the operations to be carried out should be prepared and issued for the guidance of all concerned. During the actual embarkation visitors should be excluded from either ships or jetties. This enactment should be widely notified and rigidly enforced.

Preparations should not be made for very short voyages, as the presence of the enemy, or unfavourable weather, may always keep the troops on board for a longer time than was at first contemplated.

As soon as the tenders for transports are received, a survey is held to test by a careful inspection the fitness of the various vessels for the comfortable accommodation of troops and of horses, to ascertain if they are clear of vermin and bad smells, and to consider what steps should be taken to improve or add to the existing ventilation. In some cases this survey is not very easy to carry out for the ships that have tendered may not have discharged the whole of their cargo; the tender, when such is the case, should always specify the time required for the cargo to be cleared. Where this survey is not performed by a specially selected Admiralty officer it is made by a board composed of a senior officer of the Quartermaster-General's Department as President, an officer of the Royal Navy, or, in some cases, of the Marine Department, and a Dockyard builder. Army Form No. 104, or Report of Inspection, is used by the officers who conduct this preliminary survey.

In all matters relating to the taking up of ships for the conveyance of troops and their stores, the Quartermaster General's Department corresponds, through the Surveyor-General, with the Admiralty at home, or direct with its representatives abroad.

When no stores have been previously collected, or are not to be embarked under Admiralty arrangements, the Commissariat will have to invite tenders for the stores and other articles required. To know where to get them in any quantity, the resources of the port of embarkation and neighbouring markets should have been previously ascertained. The Commissariat should have become beforehand acquainted with the articles likely to be required, with the locality where those of good quality can be obtained at a fair price, with the names of the best contractors, and with the amount of each kind that can be obtained in a specified time. Where a large quantity of provisions are obtained, particularly abroad, experts should be appointed to examine them and ascertain they are all in accordance with the approved samples.

Though in a large expedition by sea, each transport ordinarily carries provisions for the troops after landing, some good steamers must be reserved entirely for the Commissariat reserve of supplies, and some fast smaller ones to enable that department to collect supplies locally from neighbouring ports.

These store ships should have an officer on board who should be accountable for the cargo to the Senior Commissariat Officer at the base, the naval authority only extending to the maritime service of the ship. This officer should have complete control over the stores, subject to the orders of the Commissary-General or other officer acting for him. Distributions on board ship are not desirable; all stores should be landed before distribution, and each ship should contain an assortment of supplies, and not only those of one kind. The charter parties should be so drawn up as to give to the Commissary-General, acting under the orders of the General commanding, the power of discharging the store ships on delivery of the cargo, or to retain them either for other services, or, if necessary, as floating magazines.

The usual rough calculation for tonnage required is 7 tons per horse or 10 for horse and cavalry soldier combined, and from 2 to $2\frac{1}{2}$ per man; too much crowding of troops in hot climates should be avoided, and, except in very urgent cases, a certain amount of accommodation should be sacrificed on sanitary grounds. The larger the vessel the better it will be adapted for the conveyance of men and animals, and there will be greater economy in hiring the best ships, namely those with superior accommodation, in preference to other ones which, though offered at a cheaper rate, are inferior in this respect. The above calculation for tonnage* will include every allowance for arms, ammunition, stores, wagons, and carts, provisions and forage from one to three months, and coals. Each steamer could well carry a supply of coals for a month, but to send a supply to coaling stations on the way should not be neglected. Steam colliers travel slower than large steamers, and the latter will reach the coaling stations before them, unless arrangements for the timely despatch of colliers are made. Supplies of coals must be prepared on the sea line of communications, with sufficient coaling barges, sacks, &c.

Each transport may not convey a complete unit, but it is acknowledged that, whatever the number of troops on board, each ship should sail from the port of embarkation complete in baggage, ammunition, camp equipment, stores, and regimental baggage animals for the troops it carries, so that these may be ready to land and act without reference to the remainder of the regiment or battery. This was done, *p.e.*, in sending the Sind Horse to Abyssinia; it will demand a larger number of transports for each regiment, but each part of a regiment being fully equipped and fully provided will be independent of the rest, and this arrangement will secure its entire efficiency from the very moment it lands. An exception might be made with regard to the regimental transport for the reasons given in Chapter II, page 19.

Wooden ships are preferable to iron ones for the transport of troops, and particularly of animals, in warm latitudes, as they are much cooler and in every way more easily ventilated. Sailing ships have more space than steam-ships, and are very good for horse transports if towed by powerful steamers. The construction of ships has materially altered during these last years, and the difficulty of obtaining steam tonnage felt in 1854-55 would not be complained of now. A very large number of steamers of great size have been built, and many of the old fine class of sailing ships have disappeared: the facility of transporting large armies by sea has therefore augmented. First-class ships are most necessary for long voyages, and the best should be

* The principle upon which the present system of tonnage measurement is based is, that the total contents of a ship below deck and of the closed spaces above deck are taken as the gross tonnage, from which, all non-freight-earning spaces, and spaces required for propelling power, are deducted in order to arrive at the net register tonnage.

obtained, at whatever cost, for these only can perform the service efficiently. The provision of boats, horse and gun flats, for the purpose of facilitating the debarkation, should be considered in the preparation of the transports. The horse and gun flats require to be fitted with inclined and fall down sterns; also, to expedite the debarkation, each ship should be fitted with six accommodation ladders, three to each side, with a broad landing platform.

The directing naval officer of the Transport Committee must ascertain the number of tons of ballast each vessel requires, and then the committee will be able to arrange with the contractors or the Commissariat, as to the amount of the stores, heavy and light, to be shipped, the order in which these should be stowed away, and the date on which the various articles should be ready to be sent on board.

As soon as the transports have been taken up, each receives a distinguishing number. The transports should be then thoroughly cleansed and prepared to receive the fittings, water-tanks, camp equipage, and stores. For cavalry, artillery, engineer train, and transport animals, the ships should be as high as possible between decks. Special transports should be told off as powder-ships, and exclusively used for powder and other combustible stores.

Fitting transports for infantry requires less time, and is far simpler work than preparing those destined for the conveyance of horses, mules, bullocks, &c.; the fittings for the first consist in tables, forms, arm-racks, pegs, battens for valises, pens for kit bags, with the necessary construction of small gear room, bread issuing room, prisoner's room, magazine, helmet room, hammock pens, latrines, cooking house, hospital and stalls for officers' chargers, also the securing of proper ventilation by the late Dr. Edmond's ventilating apparatus,* or other means. For the second, besides all the above fittings for the soldiers and drivers, there must be additional ones for saddlery and harness, and for the proper accommodation of the animals. Transports for men only, can be fitted in about 6 days, and for animals in about 10 days.

The men are divided into messes of ten each, the number of each mess being painted in large figures, even numbers on the port, odd numbers on the starboard side. Each mess is provided with the following articles:—

- 1 stout tin $2\frac{1}{2}$ gallon mess kettle, with lid to form a dish.
- 1 pair of carving knives and forks.
- 1 half-pint mustard pot.
- 1 pepper dredge.
- 1 pickle jar, to hold 4 pints.
- 1 salt jar 1 pint.
- 1 oval tin dish.
- 1 potato net (to hold 12 lbs.).
- 1 bread bag (to hold 20 lbs.).
- 1 pudding bag.
- 2 bass scrubbing brushes.
- 1 set washing tubs.

Each man is also furnished with:—

- 1 tin plate.
- 1 pint tin pot.
- 1 iron spoon.

Indian soldiers and followers are very particular about their caste, and for them special cooking arrangements must be made. A place is

* When this ventilating apparatus is used, care must be taken to prevent water running from the casing along the deck, caused by the condensing of the steam.

set apart for the reception of the sick and fitted up as an hospital, the patients being accommodated in bunks. A small dispensary is attached to the hospital and a detail of the Army Hospital Corps is now embarked with the troops and placed under the orders of the Senior Medical Officer. Soldiers who commit themselves after embarkation are confined in the prisoners' room; a square room on the main deck is prepared for this purpose, boarded all round, except at the top, which, though open for ventilation, is made secure by iron bars. This room is fitted all round with a wooden bench, the door being made fast by a stout padlock. The latrines are generally on the upper deck with a clear drop into the water.

The necessary fittings must be taken in hand as soon as possible for, unless they are kept in store, they will require some time to prepare. These can all be made either in the regular arsenals and dockyards, or by contract when good articles can be obtained by this means: all should be prepared under the superintendence of some special competent person to whom the whole supervision of the work should be confided. No alteration of the fittings should be attempted in course of completion, for this would only lead to delay. Drawings and specifications of all fittings that may be required should be kept in the constructing offices at all principal ports of embarkation, the time necessary to prepare a certain quantity, the amount of materials and of hands required to make them and put them up, should have been previously ascertained. A certain quantity of fittings should always be kept in store at the principal arsenals and ports; these can be fitted to any ship in a very short time. For short voyages less substantial fittings than the approved ones can be used, simple ones that will cause no damage to the decks. It will delay the work if stores are put on board whilst the transports are being fitted, but, as soon as this is completed, the water tanks must be placed in the hold, and the camp equipage, heavy baggage, and stores must be sent on board. All articles of food and forage required during the voyage should be placed handy above the rest. The ammunition will also be sent on board to be placed in the magazine or other safe locality assigned for it.

We may be excused treating of the fittings of the horse transports, and the management of animals on board, at some length, for it is a service in which little experience can be gained, as the opportunity rarely occurs for sending horses or transport animals long voyages by sea, and, excepting officers of mounted branches travelling between England and Ireland, others seldom have a chance of travelling in one of these ships. The officers and men of mounted branches should be instructed in the use of the fittings, likewise with the arrangement and management of animals on board ship.

Ships chartered for the conveyance of horses or transport animals should be roomy, well ventilated, and, generally speaking, built for voyages in warm latitudes. They should never be less than 1,500 tons burden: small vessels are undesirable, on account of their greater motion; wooden ships are preferable to iron ones. Vessels with 30 feet beam will allow of a row of stalls on each side with a passage of 10 feet or more in the centre, and of 2 or 3 feet between the side of the ship and the stalls (Fig. 3); any ship with breadth of beam less than this is not well suited for the transport of animals. The hatchways should not be less than 10 feet \times 10 feet; the tonnage, as we have already remarked, being calculated at 10 tons per horse. In fair weather the animals can be conveyed in sailing ships towed or not by powerful steamers, but, as steamers can perform a voyage in about one-third the time of sailing ships, and, as the longer the time em-

ployed on the voyage the more injury will the health of the animals sustain, it becomes a matter of consideration, especially in tropical climates, to shorten the duration of the voyage as much as possible.* In calculating the losses in animals during a sea voyage, no account is ever taken of the number which never recover after landing, thus the true loss is never fully ascertained. Steamers are more economical, for, as they can perform two voyages to one of sailing ships, only half the tonnage will be required.

The height between the planking of the decks should never be less than 6 feet 6 inches; in the summer months only, horses and transport animals can be accommodated on deck without risk, but, during the heavy gales of winter and early spring, the only safe place for them is down below, and for this transports of large tonnage are required. Stalls on deck are provided to utilize space, but they add to the rolling of the ship and are liable to be washed away in heavy weather. When the transport "Queen" went to Natal in 1881, there were stalls on deck, and the ship meeting with severe weather, lost 12 horses before reaching St. Vincent. The upper deck, is also unsuited for animals, for there is more motion, exposure to great and sudden changes of temperature, hot sun, cold nights, and smells from latrines, salt-meat tubs, &c. If animals are kept there they should be blanketed and surcungled; but if possible, they should be on the main deck, being only brought up for health in fine weather. Plenty of ventilators of the most approved pattern should be provided, care being taken that these are always kept working; there should be besides ports on each side fitted with scuttles to open in bad weather, one scuttle to every 15 feet at least, each scuttle fitted with a metal scoop to catch the air: in the tropics, the Red Sea, Persian Gulf, and other localities which are very oppressive in hot weather, long shutter openings must be cut through the deck to give plenty of air to the animals below. The names of the decks, hatchways, &c., and where they lead to, should be painted in conspicuous places.

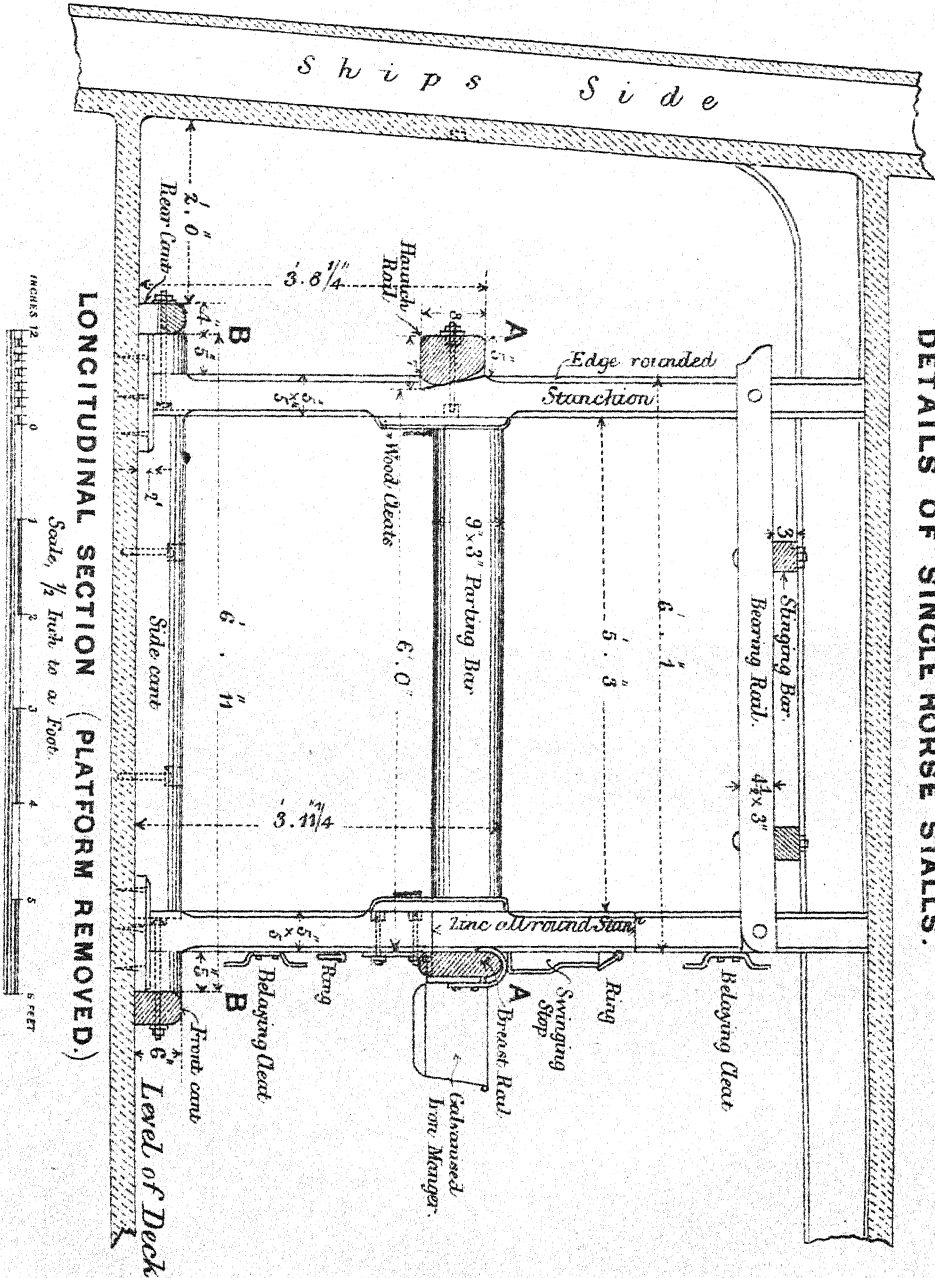
Single stalls (Plates I, II, III, and IV) are required for the accommodation of the animals to ensure their safety in rough weather, and to land them in good condition; † these are fitted fore and aft the ship, with a clear space of 2 feet between the ship's side and the cant at rear of the stalls, to enable the men to clean the animals properly and to gain free access to the ports and scuttles. Each stall has a moveable platform with four battens of oak screwed to it, to prevent the animals slipping suddenly from the rolling motion of the ship. The proper adjustment of these battens is an important point to attend to in fitting horse transports; too many of them are anything but an advantage. Passages must be left between the boards of the platform to allow the urine‡ to run off; the channel which leads it clear out of the stall should also be large enough to prevent its being continually choked with dung. The height between decks is now greater than it was in the ships of former days, and a moveable platform with battens for

* The transport "Nemesis" conveyed a portion of the 7th Hussars to Natal in 1881, and lost on the voyage between Kingstown and Cape Town 39 horses. Of these, 13 died from fever and exhaustion, caused by the severe rolling of the ship; 22 from heat apoplexy; the result of being confined for too many days in close and heated atmosphere; 2 were destroyed by accident, and 2 died of ordinary disease. The slow rate of speed of the ship, and the frequent stoppages, were assigned as the causes of the death of the 22 horses lost from heat apoplexy.

† Arab horses are brought down the Persian Gulf to Bombay in country boats with no stalls, but packed so close, that, though all of them are stallions, they cannot injure one another.

‡ The urine from the stalls runs through pipes into urine tubs, which are emptied from time to time.

FITMENTS FOR HORSE TRANSPORTS. DETAILS OF SINGLE HORSE STALLS.

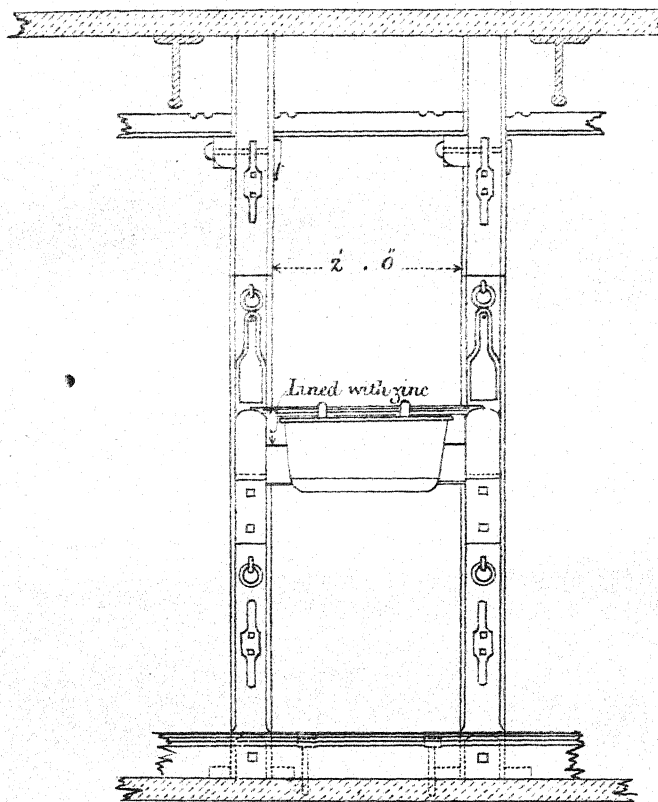




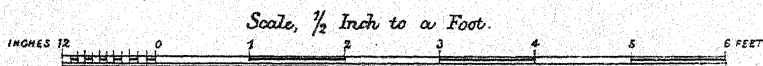
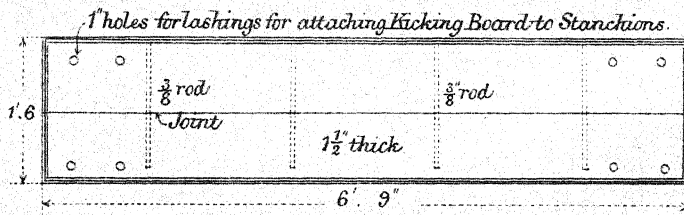
FITMENTS FOR HORSE TRANSPORTS.

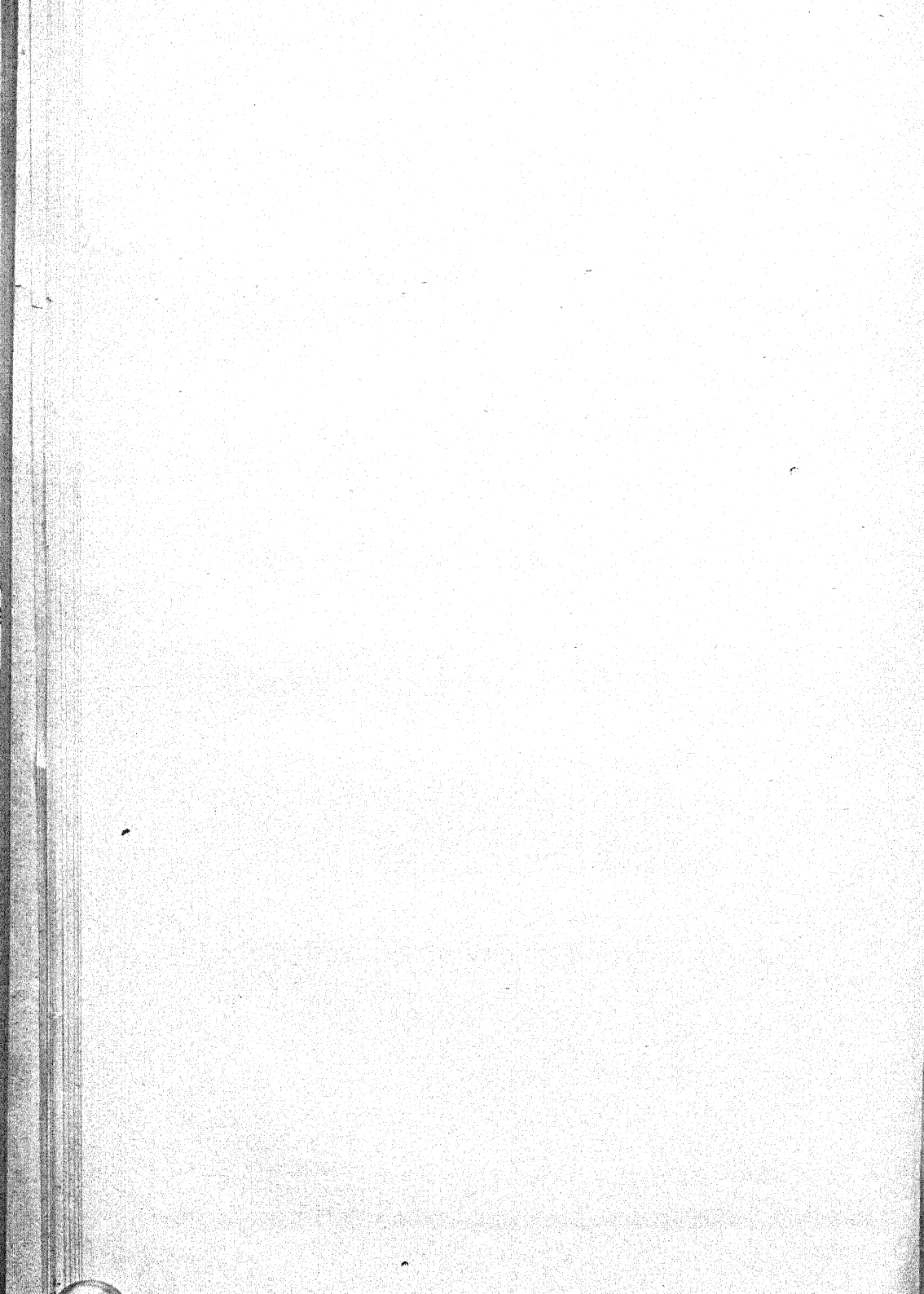
DETAILS OF SINGLE HORSE STALLS.

FRONT ELEVATION



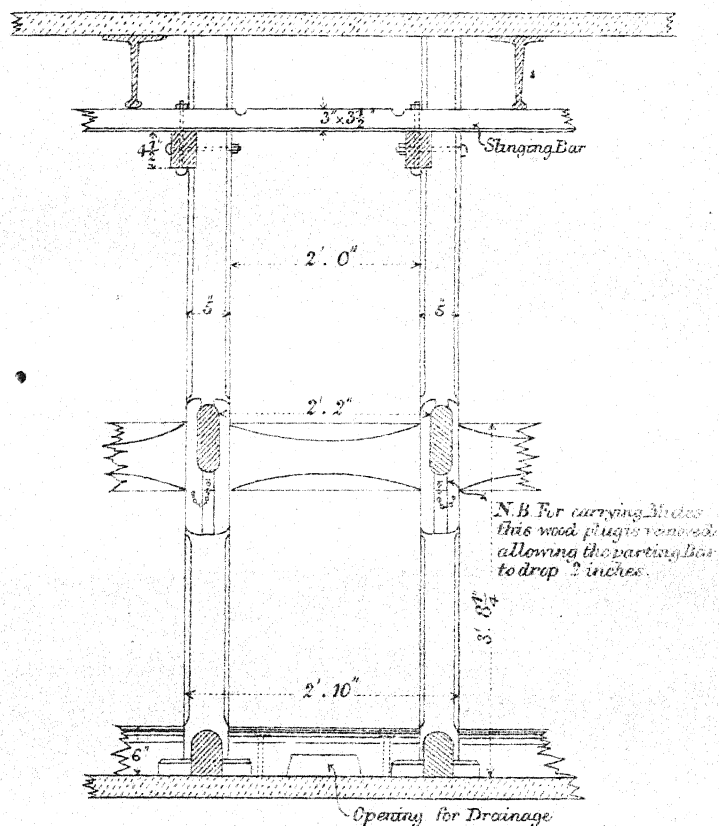
ELEVATION OF KICKING BOARD.





FITMENTS FOR HORSE TRANSPORTS.

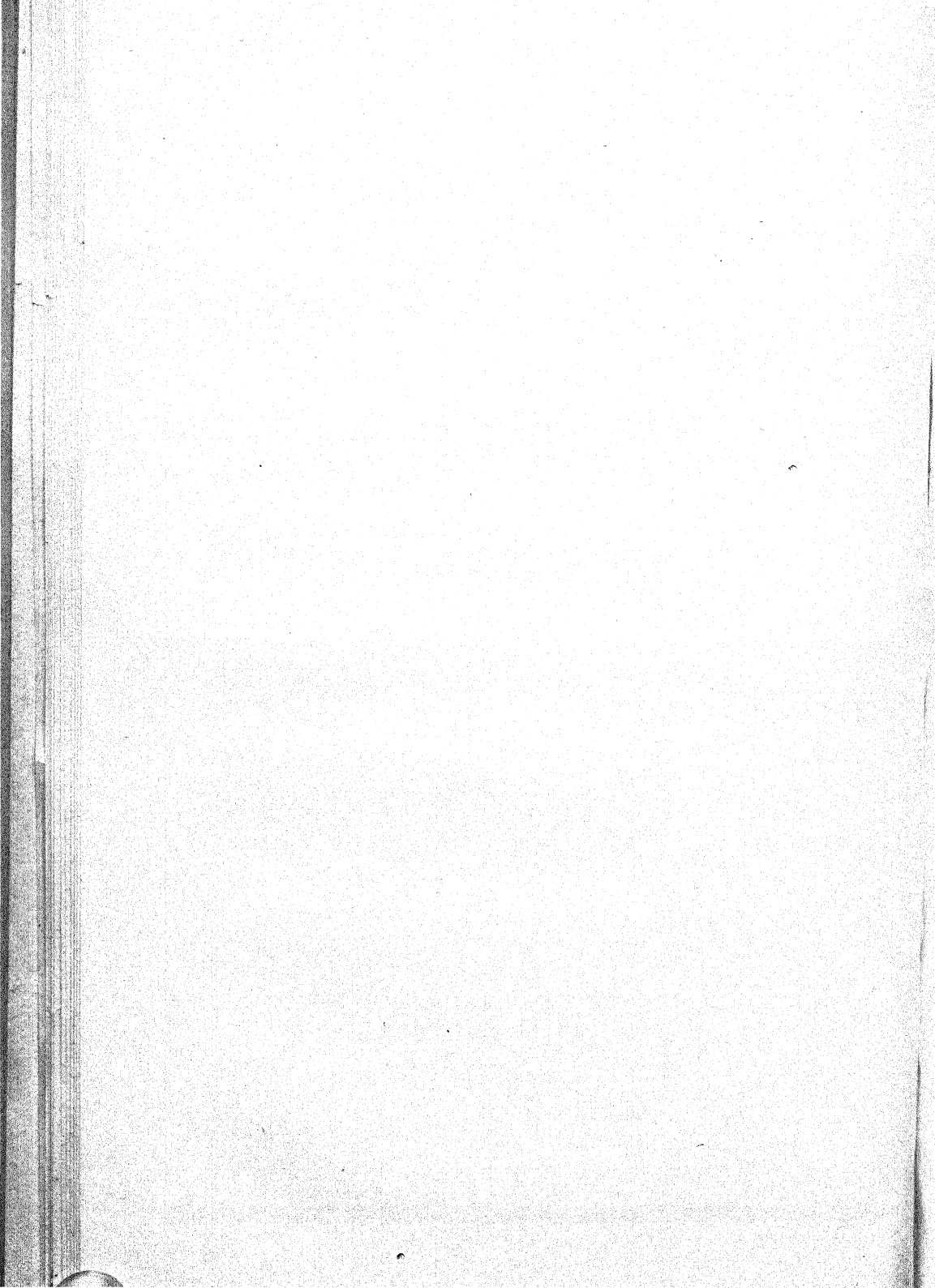
DETAILS OF SINGLE HORSE STALLS.



CROSS SECTION (PLATFORM REMOVED)

Scale, 1/2 Inch to a Foot.

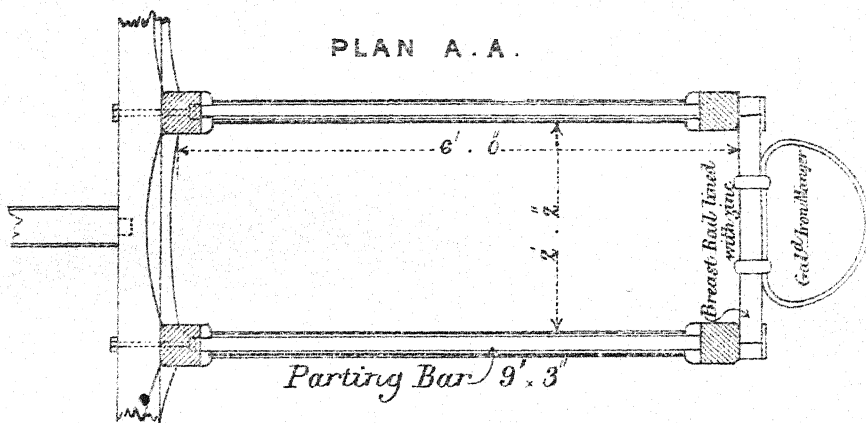




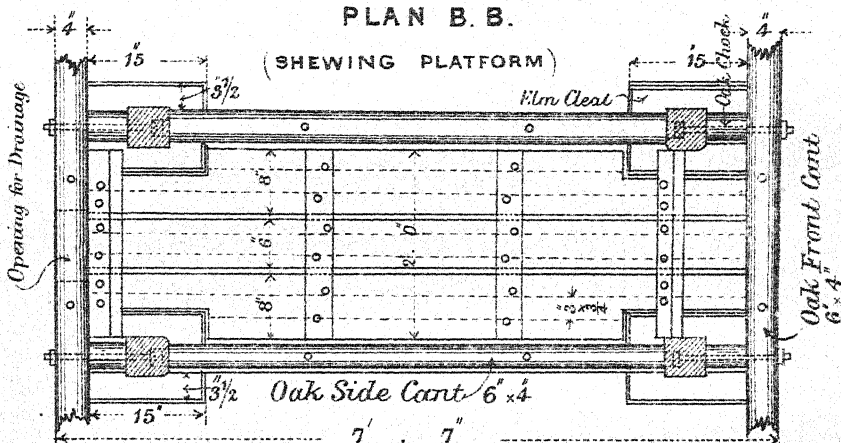
FITMENTS FOR HORSE TRANSPORTS.

DETAILS OF SINGLE HORSE STALLS.

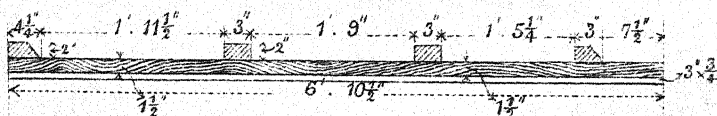
PLAN A. A.



PLAN B. B.

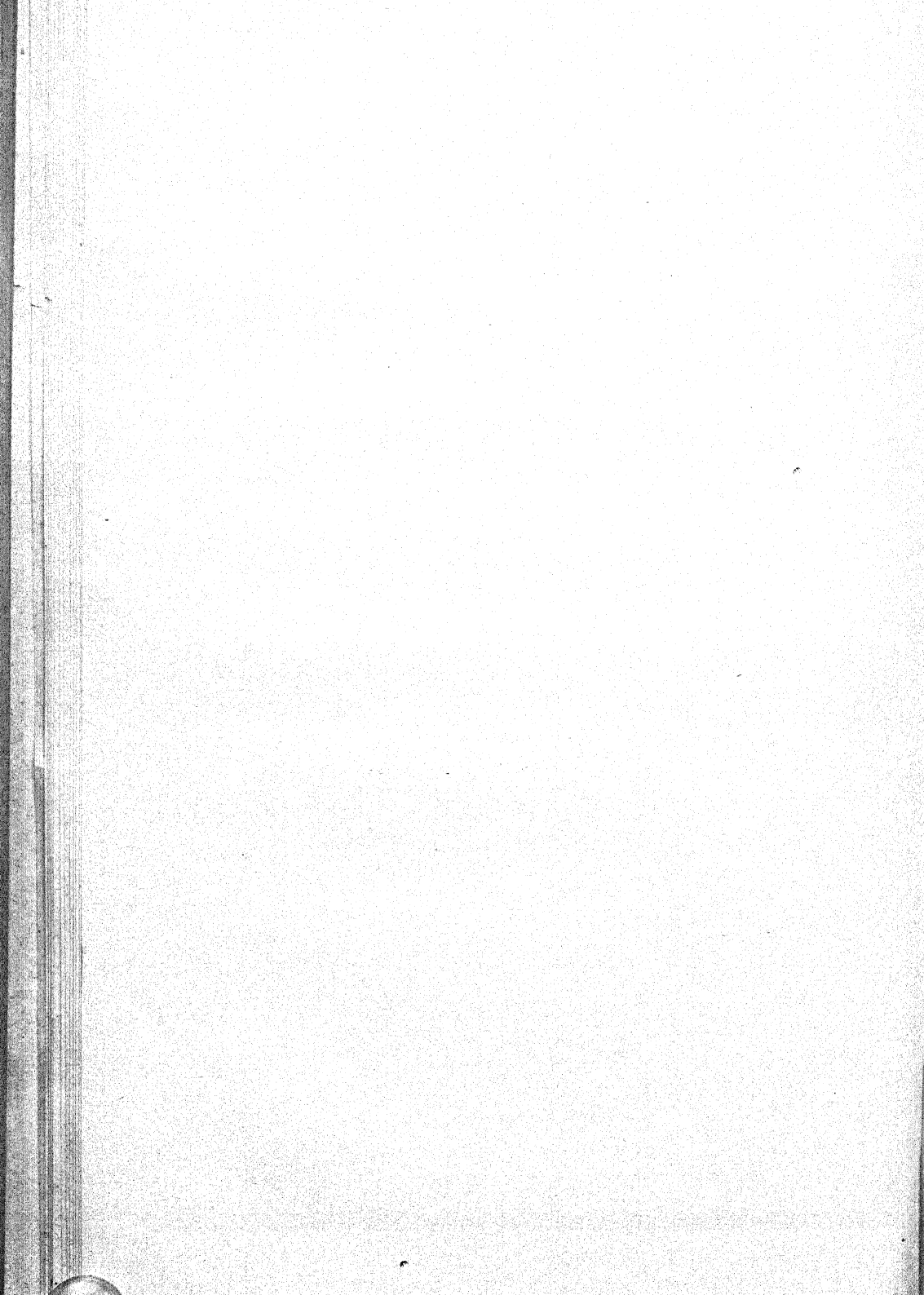


LONGITUDINAL SECTION OF PLATFORM



Scale, 1/2 Inch to a Foot.





the animals to stand on is provided; this will enable the decks of the stalls being more completely cleaned than was possible formerly when the battens were nailed or screwed to the decks. Coir mats are advocated by some for use in place of battens, as coir gives an excellent footing; the objection to their use in place of battens is that they would not stand the wear and tear of the shoes when these are not removed. Coir mats will be found useful in rough weather, but should only be used then, and taken up and dried as soon as no longer required, otherwise they will stink and become full of insects. When used, they should be placed across under the fore-feet; one length will suffice for 3 or 4 stalls. When no coir mats are available, fine cinders or sand should be sprinkled over the floor of the stalls.

Stalls should be prepared to accommodate the description of animal to be carried; the same stalls are not suitable for all animals alike, thus, if horse stalls were occupied by mules, there would be too much room and the animals would be jerked backwards and forwards with each motion of the vessel. Ten per cent. of breast pads are issued as haunch pads to shorten the stalls if necessary. Larger stalls than the rest are provided in the proportion of 5 per cent.; horses should be selected for these before embarking. To distinguish these stalls from the rest the words "large stalls" should be painted on the longitudinal batten.

For horses, each stall should measure between the bales from 2' to 2' 2" in the clear fore and aft, and between the stanchions athwartship from 6' 6" to 6' 9". Although 2' 2" in the clear between the bars is the rule, for small horses, 2' is enough, and, even at home, this last dimension has been found sufficient. For mules, 5' 6" \times 1' 8" inside measurement of stall is allowed, and for draught bullocks 6' \times 2'. Pack bullocks, ponies, and donkeys are generally placed by threes in pens, each animal being allowed 5' in length, and 1' 8" in breadth.* Elephants are placed in the hold of a ship, where the motion is felt the least, a temporary flooring, made of stone or shingle, is prepared, and the animals are placed tail to tail with their heads towards the ship's sides; each stall should measure 14' \times 6'.

All angular objects in the stalls against which a restive animal may come into violent contact should be rounded off; this above all should be done to the cross rail above heads, for animals frightened in rough weather, will suddenly jerk their heads up and be severely hurt by the angular edge. All projecting bolts and rails which may cause injury to the animals' heads when suddenly raised should be covered. Proper india-rubber washers are needed for the bolts used to fasten the horse fittings to the deck; any neglect on this point will cause the urine to percolate and drip on to the deck below. This demands attention principally in ships with iron decks, for in those in which the decks are of wood, the wood absorbs part of the urine and prevents its percolating. This last inconvenience is also prevented by closing the pores of the wood by applying two coats of approved black varnish to the part of the decks under the stalls.

Each ship should have 5 per cent. of spare stalls, and some on deck where sick animals requiring fresh air may be removed for the purpose of recovering. This last arrangement should never be neglected where there is the available space. The spare stalls are particularly provided for the convenience of cleaning the animals; they can thus be shifted, rubbed over, and have their feet washed. The animals should be divided into batches, separated by one or two stalls,

* In the China War of 1860 the transport animals were carried in badly fitted ships, and heavy losses ensued.

according to the percentage of the spare ones allowed; by this arrangement the shifting will be carried out quietly, and simultaneously by the non-commissioned officers and men of each batch, the whole work being carried out at one time. With two spare stalls for each batch the men would shift horses one day, working towards each other, leaving the two end stalls clear, and from one another the following day, leaving the two centre stalls unoccupied.

Horses, and particularly mares in an excited state, should be taken out of the stalls, and, if possible, judiciously exercised. Loose boxes should be provided in which a sick animal may lie down and roll for a few hours; this will be found a good plan conducive to the rapid recovery of many animals. There should be one or more of these, according to the number of animals, and placed as near a hatchway as convenient for fresh air. Loose boxes have been made out of three consecutive stalls by removing two side bales, putting padded sides and hay bags for the horse to lie on. This extempore box may be prepared without moving the sick animal, which, particularly in bad weather, and when the animal is much debilitated, will often be impossible to do. When a few horses only are on board ship in stalls on the main deck, and there is sufficient room on either side of the mast, it will be found an excellent plan to lay down rough coir mats, and exercise the horses round in fair weather. This will help much in keeping them in fair condition.

The stalls should be numbered in front above the animals heads, and the mangers, side bales, and breast bars should bear the same number as the stall. For convenience in moving animals on board ship the two first stanchions at every 12th stall should be made moveable. All side bales should be moveable to be able to shift horses conveniently, being, however, so secured in their grooves as not to be easily drawn out; they are often covered with canvas and stuffed with oakum, tow, or straw, but canvass covering is bad, for it gets wet from the sweat of the animals, and in that state rubs them very much; specially prepared leather, if not too expensive, is more suitable, but a better material still is sheepskin, pretty long in the wool, doubled round the centre part of the bales. After all it seems preferable to leave the side-bales bare as has been done in the horse transports sent to South Africa in 1881.

The horses' tails should be wiped up with straw, nummah, &c., to prevent sores close to the root of the tail being produced by the constant rubbing against the haunch board: any disease at the root of the tail might give trouble and communicate to the spine.

The soldiers and drivers should have a compartment of the ship to themselves, quite distinct from the animals, and with no communication between the two. They should be under in preference to over the horses, and completely shut out to prevent their health being affected by the foul air from the horse decks. The forepart of a ship, being generally the coolest, is best adapted for the men; the animals should be amidships and as much in the centre as possible, as the middle of the ship is the place where there is the least motion. The stalls near the hatches are not always the best, the animals being there liable to get chilled when very hot. When horses are embarked for a journey in tropical climates they may be clipped with advantage; clipping machines might be put on board for the purpose, but clipping on board ship is difficult and can be done better before embarking.

The water tanks are placed in the hold, water being drawn by means of pumps. One or more good force pumps with a long leather hose will hasten the watering of the animals much, and will come in very useful in cases of fire.

Few ships have sufficient arrangements for stowing away such a

large quantity of water as is required for a large number of troops, and no point demands greater attention than the furnishing of transport ships with a plentiful supply of good water. Most ships now have a condensing apparatus, so that there is less difficulty than there was formerly with regard to water; however, there should be a sufficiency of tanks on deck to allow the condensed water plenty of time to cool before being required for drinking. For long voyages twenty days supply of water is put on board, the distilling apparatus furnishing the rest. The Admiralty requirement is that each ship should be able to distil daily one-fourth more than the regulation quantity of water for all on board. Water can be kept in iron and in wooden tanks, and in barrels. Iron tanks are the best, though sometimes difficult to find ready in any large number; new ones take some time to prepare. Wooden tanks are apt to leak unless kept constantly full, and give a taste to the water. Large iron tanks measuring 4 feet in every direction are usually arranged in rows in the hold, resting on the ballast, water being drawn from these as required by means of a suction pump. The supply of water should be ample, and to spare, not merely sufficient; the distilling apparatus also should be set to work at an early date, so as to replenish gradually the water in the tanks as it is consumed and give it time to cool. The following daily allowance for the troops and crew will suffice for all purposes; out of the tropics six pints per day, within one gallon; for horses, 8 gallons; for mules, ponies, and bullocks, 5 to 6 gallons; for elephants, 40 gallons.

Each transport carrying animals should be provided with the following articles, viz:—

- Shipping slings, 2 for every 50 animals (or portable horse-boxes* if used in place of slings).
- 1 head-collar,† stout and new, with good stout throat-latch attached, per animal; 10 per cent. spare.
- 1 triangular steel scraper for every 3 animals.
- 50 per cent. of brooms, with a reserve.
- 1 small basket with handle for every 3 animals, with a reserve.
- Some large baskets for hoisting litter up the hatchways.
- 4 peck and half-peck measures for every 100 animals.
- 10 per cent. of shovels for filling baskets.
- 1 swab for every two or three men.
- 1 galvanized iron water bucket to hold 3 gallons‡ for every six animals, 20 spare.
- Lanterns with padlocks and keys, 1 for every 10 stalls.
- A supply of tools and materials for repairing head collars, &c.
- A supply of coir mats to lay down in the passages when moving or shifting animals.
- 1 horse hammock or resting slings per stall.
- 2 mash-tubs (can be used for soaking grain if necessary).
- Tools for breaking iron bands of compressed hay.
- Saltpetre, nitre (plenty to mix with mashes), vinegar, linseed, mustard, &c., should be shipped according to the number of

* Portable horse-boxes, with slings complete, are provided in the following proportion,—1 for each vessel carrying animals, 2 if not exceeding 200 animals, 3 if over that number.

† Mules require head chains, for they are given to eating the ordinary head ropes.

‡ The water buckets should be of wood or galvanised iron, not of canvas, for canvas buckets leak and wet the decks. Galvanised iron buckets are now generally supplied.

animals, distance, and probable duration of the voyage. About 8 lbs. of linseed; and 1 lb. of mustard will be required for each animal per month $\frac{1}{2}$ gill of vinegar and $\frac{1}{2}$ ounce of nitre per diem should be allowed over and above the quantity put on board with the medicines.

1 oz. chloride of zinc, 2 oz. gypsum, and 5 ozs. MacDougall's disinfecting powder for each animal daily.

A liberal supply of spare battens and a percentage of all fittings, especially side and breast bales, which are likely to get broken in rough weather.

The animals should be embarked in the same ship with their riders or drivers and equipment. The men should be told off into messes before going on board, and should be medically examined before embarkation. The animals likewise should be inspected by a Veterinary Surgeon, no animal being allowed to embark that shows the least symptoms of suffering or of having lately suffered, from any contagious disease.

The arrangements for the detail of Medical officers, apothecaries. Army Hospital Corps men, &c., belong to the Senior Officer, of the Army Medical Department, at the port of embarkation, who is the proper officer to see that the necessary hospital accommodation is prepared, and a supply of medicines and hospital comforts are put on board of each ship. The second Deputy-Surgeon General at the base is the officer responsible for the embarkation of the sick and wounded to be sent home or to convalescent depôts. Whilst trans ports are being fitted, a medical officer should be attached to the Transport Committee to supervise the sanitary arrangements. The P.M.O. at the port of embarkation is responsible that a careful medical examination is made of all parties before embarkation, so as to detect any symptoms of contagious disease.

The Inspecting or Senior Veterinary Surgeon will have charge of inspecting the necessary fittings for all transports hired for horses and transport animals, and should, above all, devote his attention to the ventilation, which is a most important point to attend to in these vessels. The arrangements for veterinary aid, the proper supply of medicines, and the inspection of all animals before embarkation, are some of his duties. In ships in which Veterinary Surgeons are not embarked, instructions for the use of the medicines supplied and management of the animals on board should be framed and handed over to the military officer in charge.

The Principal Medical and Veterinary Officers must be supplied at an early date with a complete detail of the ships taken up, and should report, for the information of the Officer Commanding, when all their arrangements have been completed.

The diseases animals are most subject to on board ship are cold and coughs, colic, debility, fever, inflammation of the eyes, inflammation of the lungs, looseness of the bowels, mange, skin wounds, suppression of urine, and frenzy. The heat is very distressing to horses on board ship, and apoplexy is one of the prevailing diseases; still on the whole, horses suffer more at sea from the motion of the ship than from heat. Sea sickness, the result of the motion, causes congestion of the brain, ending in madness, which proves rapidly fatal. With the best arrangements there are horses of a delicate constitution, old, or predisposed to disease, that will not be able to stand the sea-sickness. Mules adapt themselves to board ship life more readily than horses and suffer less. The health of the animals depends on a favourable voyage, and on the attention bestowed on them by the Veterinary

Surgeon, and all officers and men on board.* A Veterinary Surgeon, native farrier (solutree) or cattle doctor should be on board of each transport, with a suitable store of medicines.

The medicines and instruments are packed in veterinary field chests, a pair of which are embarked with each Veterinary Surgeon. The contents of these two chests are as follows:—

Veterinary Field Chest.

No. 1.

Medicines.	Weight.		Instruments.	No.
	lbs.	oz.		
<i>Bottom of Chest.</i>				
Spts. Ether Nitrosi ..	Glass bottles	1 8	Compo Mortar and Pestle ..	1
Spts. Ether Nitrosi ..		1 8	Ointment Slab	1
Spts. Ammon Aromat ..		1 8	Grain Scales and Weights ..	1
Ol Lini	Tin bottles	1 8	Spatula	1
Ol Lini		1 8	2 oz. Graduated Glass Measure ..	1
Spts. Terebinth		1 8	Seton Needle and Handle ..	1
Spts. Terebinth	Tin	1 8	Suture Needles	6
Ol Canth		1 8	Hanks, Wire for Do.	2
Tinct. Amica		1 8	Tow .. ..	..
Aloe Barb.	Tin Canisters	1 8	Drenching Horn	1
Gintian		1 0	Bandages, Flannel, sets ..	2
Zingib.		1 0	„ Linen „	2
<i>Lift out Tray.</i>				
Acid Acet.	Glass bottles	2½	Weight of Chest when empty, without Bottles or Canisters, 29 lbs.	
Cupri Diniod		4		
Hyd. Subchl.		4		
Hyd. Perchl.		4	Total weight, including Bottles, Canisters, Medicines, Instruments, and Surgical means, all complete, 77 lbs.	
Hyd. Iod. Rub.		4		
Opil Pulv.	2			
Ferri Iod.	4			
Ink	3			
Antim Tart	5			
Antim Tart	5			
Cretæ Præp.	4			
Cupri Sulph.	5			
Plumbi Acet.	4			
Ext. Belladonna	4			
Ung. Hyd. Iod. Rub...	4			

* In the expedition of reinforcements to Natal for the Zulu war, over 2,000 horses were embarked and sent to Durban, a distance of about 7,000 miles, the voyage lasting from 30 to 40 days, and, though the preparations were rather hurried, the loss of animals in transit only amounted to 2·77 per cent., the landing being effected without a casualty. The principal diseases were pneumonia, pleurisy, congestion of the lungs, enteritis, apoplexy, and encephalitis. The principal injuries were abrasions and contusions. The horses reached Durban, having not lost much weight, but, as a matter of course, soft. Mules stood the voyage well. After landing, the weak and delicate horses were at first put up in sheds out of the sun for a couple of days, which freshened them up considerably. In the China war of 1860, the casualties in horses from India to Hong Kong amounted to only 3 per cent.

Veterinary Field Chest.

No. 2.

Medicines.	Weight.		Instruments.	No.	
	lbs.	oz.			
Bottom of Chest.					
Liquor Ammon Fort..	Glass Bottles.	1	8	Bladders	2
Tinct. Opii		1	5	Side Line :	1
Camphor		1	0	Blinds	pr. 1
Potassæ Nitratis Pulv.	Tin Canisters	1	8	Clyster Pipes	2
Potassæ Nitratis Pulv.		1	8	Drawing Knife	1
Terebinth Vulg. ..		1	8	Searcher	1
Lift out Tray.					
Spts. Rectif.	Glass Bottles	7	2 oz. Syringe	1	
Tinct. Myrrh.		7	Curved Scissors	pr. 1	
Sulph. Zinc		6	Firing Iron	1	
Canth. Pulv.	Glass Bottles	3	Phleme and Stick.	1	
Ammon Carb.		4½	Tin Pint Measure.	1	
Ammon Carb.		4½	Tow	1	
Aluminis Pulv.	Tin Canisters	8	Bull's Eye Lantern	1	
Ferri Sulph.		10	Whalebone Probes	2	
Ferri Sulph.		10	Sponges	2	
Resina	Tin Canisters	8	Metal Probe	1	
Ung Hydrarg Fort		8	Pins	oz. 2	
Adipis		10	Twine	oz. 4	
Argent Nitratis in special bottle ..		1	Bullet Forceps	pr. 1	
Sapo Dur, in paper		2	0	Tape	pieces 4
Weight of Chest when empty, without Bottles or Canisters, 29 lbs.					
Total weight, including Bottles, Canisters, Medicines, Instru- ments, and Surgical means, all complete, 77 lbs.					

In cases where veterinary field chests are not embarked the following medicines should be put on board, and will be found sufficient for 100 animals on an ordinary voyage:—

No.	Description.	Quantity.	Dose.
1	Sweet spirits of nitre.. .. .	2 qts.	1½ to 2 oz
2	Laudanum	2 "	1 to 2 oz.
3	Camphor	2 lbs.	1 to 2 dr.
4	Tartar emetic	2 "	" "
5	Nitre (saltpetre)	12 "	½ oz.
6	Aloes	2 "	3 to 5 dr.
7	Powdered gentian	2 "	2 dr.
8	Sulphate of iron	2 "	2 "
9	Spirits of turpentine.. .. .	2 qts.	1½ to 2 oz.
10	Prepared chalk	4 lbs.	1½ to 3 oz.
11	Carbonate of ammonia	2 "	2 to 4 dr.
12	Linseed oil	8 galls.	1 to 1½ pt.
13	Mustard	6 lbs.	" "
14	Powdered ginger	2 "	2 to 3 dr.
15	Sulphur powder (for mange ointment)	8 "	" "
16	Tar	6 "	" "
17	Sulphate of zinc	2 "	" "
18	Sugar of lead	2 "	" "
19	Blue stone	4 oz.	" "
20	Calomel	4 "	½ to 1 dr.

These medicines should be packed in strong bottles in boxes, a printed label being pasted on each bottle with the name and also with the number according to which they come on this list. With the medicines should be the following articles:—

1 pestle and mortar, 1 box of scales and weights, 1 pint pewter measure (for oil, etc.), 1 4-oz. graduated glass measure, 1 fleam, 2 drenching bottles, 1 injecting apparatus, 1 pair scissors, 1 knife (spatula), a supply of soap, 6 linen and 6 flannel bandages, 4 fomenting cloths, 6 suture needles, wire and thread, 1 balling iron (regulating.)

Horse hammocks or resting slings are used to allow the animals to throw their weight on them, and rest their legs; these should never be so tightened as to lift them off their legs. Horses meet the rolling motion of the ship by throwing the weight of their body in a contrary direction to the motion of the ship. The hammocks, therefore, should not be braced up tight in rough weather, for the animals will require the free use of their legs to preserve their balance, and swinging about could only cause them injury. If hung loose, 6 inches clear of the animals, these may come useful in preventing their falling. In calm weather the hammocks may be tightened more to give the animals a rest, but then only for stated periods. It has been observed that, as a rule, few animals rest themselves much in the hammocks.

Ventilation and cleanliness are the principal points demanding attention on board transport ships carrying animals. No baggage of any description should be allowed on the stable deck. Constant attention should be paid, particularly at night, to the trimming of the windsails and ventilators, as the health of the animals depends on nothing so much as on their getting plenty of fresh air. Special intelligent men should be told off to look after the ventilators and lanterns. The common canvas wind-sail is considered, after all, the best appliance for securing proper ventilation; a dozen of these should be placed on board

of each transport, to be used, at the discretion of the officer commanding, for the stable deck. Of the transports sent to Natal in 1879, it was stated that Dr. Edmund's steam ventilator caused continual drip, wetted the deck and made everything damp and difficult to dry. These defects have been remedied, and this ventilator will be found now to be of real service. Printed instructions how to use the windsails and ventilators should be given to the Commanding and Medical Officers; other copies have lately been hung up in conspicuous places about the decks for general information and guidance. Particular care should be taken at night, for it has been noticed that the worst attacks of sickness come on about ten or eleven o'clock at night. In a horse transport going to Natal it was remarked that few nights passed without a case occurring.

The following explanation of Dr. Edmond's system of ventilation for board ship is borrowed from some directions issued for the information and guidance of the officers in charge of the troops:—

"This system of ventilation is not intended to take the place of windsails, air scoops, &c., but as an additional means of distributing fresh air along the lower decks, or of drawing off the foul air.

"The apparatus consists of one or more main ventilators (each with a moveable cowl) communicating below with wooden shafts which extend fore and aft either along each side or amidships. These shafts have apertures covered with perforated zinc every 5 or 6 feet, by means of which the ventilating action is established.

"To exhaust Foul Air.

"Turn the cowl from the wind, turn on the steam from the main, then open the "blow-off cock" A (Fig. 4), and keep it open till nothing but steam comes from it; then close it, and open the "steam cock" B; this forces the steam through the steam jetter C, and creates a vacuum in the air shafts which causes the air to be sucked in through the apertures and carried up the main ventilators, its place being, by the laws of gravitation, supplied down the hatchways, &c. In all weathers it is most useful to use this means of ventilation for half an hour after each meal, and occasionally during the night. In hot close weather, it can with advantage be kept continually going. Great attention must be paid to keeping the cowl trimmed away from the wind, or the steam will be blown down through the funnel and along the shafts. If the cowl is kept trimmed, and the directions about turning on steam attended to, and the tank D emptied occasionally, the apparatus will work well, and there will be no wet about the decks.

"To Diffuse Cool Air.

"When there is a good breeze, and no accumulation of foul air on the decks below, the apparatus may be used to advantage without steam. Turn the cowl to the wind, and the fresh air will run down the main ventilators and along the shafts, and out through the apertures.

"The action of the ventilating apparatus can be seen by holding a lighted candle to one of the apertures, when, if the steam is in use, the flame will be drawn in, and if the steam is not in use, and the cowl turned to the wind, the flame will be forced from the aperture.

"The figure will show the working of the apparatus. The steam pipe from the main cannot be shown, as it is taken from wherever it is most convenient, and so varies with each vessel.

"The whole apparatus is very simple, and, if these directions are attended to, cannot fail."

To the above should be added the following simple observations, which, if attended to, will further ensure the working of this apparatus. The position of the main ventilators should be carefully considered when fitting out each ship: these should be placed where they can be used at all times, so that for no reason whatsoever the working of the apparatus may have to be stopped. The pipes should be water-tight and used entirely for this purpose. The cocks by which the steam is turned on and off should be only accessible to the men placed in charge of these ventilators, who should also attend to the occasional emptying of the tanks.

In the Abyssinian Expedition, and again in the expedition of the Indian contingent to Malta in 1878, in horse and cattle transports, several running feet of planking were taken up from both sides of the deck, above the horses' heads, and fitted with hatches which could be closed in rough weather. These ventilators, which were invaluable, particularly in the oppressive climate of the Red Sea, extended from the break of the poop to the break of the forecastle, and were provided with a combing, which prevented the water used in washing the decks from falling on the deck below. Ventilators of this description are always provided when possible and when the decks are not of iron.

Pankahs have been used with advantage, and in the late expedition of the Indian contingent to Malta thermantidotes were used to clear the atmosphere on the stable deck. The great advantages claimed for these appliances were hardly realized, for in reality it was found that only the foul air quite close to the mouth of the instrument was cleared by them. In one of the ships which carried the 1st Bombay Lancers this defect was obviated by an ingenious and simple device. A long canvas tube, ending in a wooden frame about a foot square, was attached to the mouth of the instrument, and by means of this tube a current of fresh air could be directed on any stall where the animal that occupied it showed signs of distress, or on any part of the deck where the air was found to be very foul.

During the voyage the men can be drilled or instructed in the use of their arms. Useful lectures can be given by the Veterinary Surgeon on the treatment and diseases of the animals, by the Medical Officer on the care and treatment of the wounded, and by other officers on the nature of the country about to become the theatre of war, its people, the organization, dress, and peculiarities of the enemy's army, former wars, &c., all this will tend likewise to relieve the monotony of the voyage.

Soldiers and drivers on the voyage should be told off for stable duties, to remove dung, sweep up litter, and watch the animals. In very rough weather they should stand by the animals' heads to reassure them. Each man should be provided with a curry-comb, brush, hand rubber (coir), picker and two towels. These articles should be provided for the voyage, those brought on board by the men should be kept complete and in good order for use after landing. Grooming, hand-rubbing the legs, and sponging eyes and nostrils, should be constantly done. Horses suffer on board ship by not being permitted to lie down. The legs and feet require great attention for, when landed, nothing is more important than the soundness of these parts. The animals should be groomed for a short time several times a day, but, under any circumstances, when practicable, they should be well groomed and have their feet picked out once a day: every attention should be paid to the feeding and watering. The mouths, nostrils, and occasionally the hocks, particularly of sickly animals, should be sponged with diluted vinegar.

Horses should never be embarked whilst in a high condition, but should be prepared for sea by being kept on soft food for some days

previous to embarkation, with plenty of long, slow, steady work. The oats should be cut down to one-half, bran being substituted for the other half. A dose or two of physic is only recommended for horses predisposed to obesity. All animals should be embarked cool, and not in a hot and wet state from work; they should be rested after a long march, and be thoroughly groomed before being put on board. When animals are to be slung on board ship, they should be kept fasting for some hours before embarking, to prevent any injury being done to them in hoisting them whilst their stomachs are distended with food; they will also more readily take to their food after being put on board, and will thus soon get reconciled to their new quarters. Food for the first few days should be given rather sparingly, and bran should form the larger portion of the diet; more than 4 lbs of oats will be rarely required, and in hot weather the allowance can be even reduced as low as 2 lbs., the food being made up to 10 lbs. with bran: too large a quantity of oats is apt to produce stoppage of the bowels. When the appetite of the animals increases they should be fed more liberally, till when within a few days of landing the full ration may be given to get the animals into condition. The feed might begin with 5 lbs. of oats, 5 lbs. of bran, and 10 lbs. of hay; after two days the oats being reduced to 3 lbs., 3 lbs. of carrots being added. When carrots are finished, the corn can be increased. Nitre given twice a week will be ample.

After three weeks at sea, on long voyages, the corn can be increased to 7 lbs., the bran being reduced to 3 lbs., and the hay augmented to 12 lbs.

When animals on landing will have to be fed on a different description of forage from what they have been accustomed to, it will be a wise plan to break them into it during the voyage, to avoid the change of food affecting their condition after landing, just when they should pick up condition and recover from the effects of the sea voyage. Carrots, when procurable, are very good, particularly for weak animals; when horses will eat nothing else they will not refuse carrots.

Proper tin-lined bins for oats and bran, to keep these articles in good order and from being spoilt, as also to prevent rats getting at them, should be provided. Not more than one day's allowance of forage should be got out of the hold at a time. Forage should be kept perfectly dry and clean, all precaution being taken to prevent its getting heated before or after shipment. Any forage impregnated with the effluvia of the stables will become distasteful and injurious to the animals; for this, amongst other reasons, no forage should be allowed to remain lying about the decks. Bran should be stowed in tight casks, and the hay should be compressed when it is perfectly dry. Bran has lately been shipped in a compressed state to economise room, being compressed in 100 lbs. square bales, packed in canvas and iron bound.

The daily scale of sea forage for animals on board transport ships is as follows:—

Horses or Mules.

Oats or grain	..	..	..	..	5 lbs.
Bran	..	..	..	..	5 "
Hay	..	..	..	..	10 "
Nitre	..	..	..	..	$\frac{1}{2}$ oz.
Vinegar	..	..	..	..	$\frac{1}{2}$ gill.

Water, 8 gallons.

For the first few days 3 lbs. of oats and 7 lbs. of bran is about the best ration.

Ponies and Asses.

Grain	..	..	..	..	4 lbs.
Bran	..	..	..	..	1 "
Hay	..	..	..	..	10 "

Water, 5 to 6 gallons.

Camels.

Grain	..	..	..	..	4 lbs.
Forage	..	..	..	..	30 "

Water, 8 gallons.

Bullocks.

Grain	..	..	..	..	3 lbs.
Straw or hay	..	..	..	..	12 "

Water, 6 gallons.

Elephants.

Grain	..	..	..	..	4 lbs.
Rice or flour	..	..	..	..	20 "
Salt	..	..	..	..	2½ "
Hay or kuben	..	..	..	..	175 "

Water, 40 gallons.

Water should be given three times a day, viz., in the early morning, at noon, and again at evening stables. In the tropics it might with advantage be given four times a-day. It is of the greatest importance that animals should be watered as early as possible in the morning, for it will check any feverish symptoms that may have come on during the night.

Careful feeding and watering on board are very necessary and conducive to the preservation of the health of the animals; the officers must look to this, and men might be specially detailed to look entirely after the feeding of each batch of 15 or 20 animals. Horses will not feed well until they have got accustomed to the motion of the ship.

When the transports are ready to put to sea, the equipment should be sent on board first, the articles required first on landing being put on board last. All stores for the use of the troops on board on the voyage should be well marked outside with the nature of the contents and weight. The wheels of all carriages should be removed (the lynch-pins and washers being carefully stowed away), and the carriages, once on board, should be lashed and made fast. In transports for mounted troops a saddle room is provided in which are arranged rows of wooden bars, padded and covered with canvas, for the storing of the saddlery and harness. These articles should be stored there, being removed always when any cleaning has to be done, as for this the deck and not the saddle-room is the proper place.

Some officers recommend that the hind shoes of horses and mules should be removed. It has been, however, decided that they are to be kept on, as, if the shoes are removed, the feet suffer much in voyages of any length. If horses go on board when their turn for shoeing approaches and the journey is long, their shoes will be easily cast off or wrenched, it will in that case, and in all cases of well known kickers, be advisable to remove them. Where the shoes have been removed, if the hoof of the animals shows considerable wearing down, they should, if possible, be reshod, though shoeing on board ship must always be a difficult matter.

If the depth of water is sufficient to allow the ships to come along

side of quays or wharfs, the animals can either walk on board, which is the easiest way, and effects a great saving of time, or be slung on board, the yard being brought plumb on the shore. For the first, one or more good gang boards with planked sides, 3 feet high, furnished with cross battens, 18 inches apart, are required. The animals can then walk on board, and down an inclined plane to the horse deck, or be lowered there in horse-boxes. When floating wharves formed of pontoons, casks, or boats can be constructed, the animals can be walked up close to the ship's side and be slung on board. The flooring of these floating wharves should be covered with straw or grass, the quietest animal always leading. Floating wharves of this kind have the advantage that they can be moved from the side of one ship to another. The animals can also walk through the baggage port direct on to the horse deck, which will save the trouble of slinging, but these ports are generally only suited for the admission of small animals. This was tried in H.M.S. "Orontes," when she took cavalry to Cyprus, and some of the officers' chargers were so embarked lately at Southampton, and at the Albert Docks, North Woolwich, but the ports, as a rule, were found to be far too low. If the ships are out in the offing, far from the shore, large flat-bottom boats, fitted with hand-rails, capable of accommodating a good number of animals, will be required. These boats can be towed alongside the transports, by steam tugs, and the animals slung on board from the yard-arm. In the latest embarkation of horses at North Woolwich, horses were embarked by the assistance of hydraulic cranes, working one forward, the other aft simultaneously, and it was calculated that 60 horses could thus be embarked in one hour. The horses were put in horse-boxes, hoisted by the crane and lowered on to the horse-deck. In using horse-boxes, if the animals refuse to enter them, they may be gently forced in by being pushed forward with a breeching strap; blind-folding will also be found to answer. In all cases, where practicable, the animals should not be brought out until their turn for hoisting arrives.

In slinging horses and other animals, each animal with the ship head-collar on is brought under the yard-arm, the slings are quickly attached and secured, and before he has time to plunge, he should be hoisted off the ground or boat at a rapid rate. Embarking horses with slings is considered by some more expeditious than with horse-boxes, though with the last the animals are exposed to less rough treatment and less danger is incurred of injuring them. The slings, breech and breast bands should be tested with a heavy weight before being used. From 30 to 40 horses or mules can be easily slung on board in one hour. During the embarkation of the Indian troops for Malta in 1878, the average time occupied in slinging the troop horses on board from boats was two minutes per horse. In embarking the cavalry for Natal in 1879, the horses walked on board by two gangways, and were then let down on to the animal deck in horse-boxes; at Southampton they were hoisted in horse-boxes, two working at the same time, one at each hatchway. The following was the time occupied in some cases:—

The 1st Dragoon Guards embarked 267 horses on board the S.S. "Spain," first horse put on board at 11.25 A.M., the last at 3.55 P.M.; time, 4 hours and 30 minutes. 17th Lancers embarked 263 horses on board the S.S. "England," first horse put on board at 9.5 A.M., last horse at 3.10 P.M.; time, 6 hours and 5 minutes. 1st Dragoon Guards again embarked 270 horses on board the S.S. "Egypt," first horse put on board at 11.5 A.M. last at 2.55 P.M.; time, 3 hours and 50 minutes, average .836 minute each horse. The rapidity of this last case was

reported to be mainly due to the rigid exclusion of the public from the quays during the embarkation.

The time required for the embarkation we consider after all a secondary consideration; it will be immaterial to conduct it very rapidly, for it is recommended, once the embarkation is completed, to let the ships anchor some little way off, and there lay for about 12 hours to let things shake down a bit, and let the men become familiar with the emplacement of their horses, forage, stores, water, &c., before commencing the voyage. Five men are necessary to sling an animal well; two or three more should be about the hatchways to see that the animal's head, tail, or legs are not injured in the descent to the stable deck, and three or four should receive him on alighting, and remove the slings. Animals on reaching the deck should be judiciously handled, for they will generally plunge and kick violently on first feeling their legs. The slings are removed and passed out for other animals, and each animal is in succession taken to his stall, where he should be placed in the same order as he stands in the lines or stables, for animals feel happier and feed better when standing close to those they are accustomed to be with. The animals are stalled alternately on the port and starboard side, as this arrangement hastens the embarkation. When made fast in the stalls, their heads should at first be tied rather short than otherwise.

The moment his animal is stabled the soldier or driver moves on board; his arms, kit, and saddlery should be deposited before the embarkation of the animals commences, in the place pointed out to him by a non-commissioned officer told off to superintend this part of the work. The ammunition is stowed away in the ammunition room, which is a room set apart and purposely prepared for it reception; this room is lined with wood throughout, none but copper nails being used in the work: the entrance to it is closed by a stout wooden shutter, made secure by means of a padlock. A place is set apart for the helmets and partitioned into many shelves or receptacles 11" by 11", each receptacle will hold 3 or 4 helmets in a nest one fitted inside the other; a rope in front of each shelf keeps the helmets in their place and prevents their falling out. As soon the whole embarkation is completed, the men should be shown their fire quarters, the Commanding Officer reporting to the embarking officer that this has been done. Fire parades should be frequently held, and instructions to follow in case of fire should be hung up in conspicuous places.

The utmost possible attention should be given to cleanliness on board of ships laden with horses and transport animals, disinfectants being freely used. Chloride of zinc, two pounds mixed with five gallons of water will be sufficient for bilges, the bilge water being diluted with fresh water, and pumped out before pouring the chloride of zinc. MacDougall's disinfecting powder, three ounces to one gallon of water, sprinkled through the rose of a watering pot will be found sufficient for decks. If used dry a good sized dredger will be required; for latrines, five to eight ounces of powder to one gallon of water will be ample. Old blankets or other woollen articles saturated with a strong solution of MacDougall's powder, and hung up between decks, where the atmosphere is offensive, will soon purify it.

Several copies of the regulations for stable duties and the management of animals on board ship, boards containing scale of rations, regulations about smoking,* instructions regarding Edmond's steam

*Arrangements for lighting pipes are necessary; generally a slow match in a tub is provided for this purpose, lucifer matches, &c., being prohibited as a precaution against fire.

ventilator, etc., are hung up for general information and guidance in the most conspicuous places of the stable deck. The routine of duties laid down in the Queen's Regulations, Section XVII, should be closely followed in transports carrying horses and transport animals. The following is the routine of stable duties recommended therein :—

Morning Stables.—Sweep up the passages behind the animals, rake out stalls to the rear, and sprinkle disinfectants. Water the animals, sponge out nostrils, eyes, etc. Feed with hay after watering, and with mash the last thing. Sweep up the decks, and sprinkle disinfectants. Time, one hour and a quarter.

Mid-day Stables.—Parade at 10 o'clock. The spare stalls to be well cleaned out, then shift over the next animal after cleaning him on that side, pick out and wash the feet, examine the shoes; any loose shoe to be fastened at once, and slight injuries attended to; thoroughly groom the body, brush and handrub the legs, brush out the mane and tail, sponge nostrils and face. The stall to be well cleaned, mats, if any, taken up and shaken, platforms to be raised and cleaned, and disinfectants used freely. The next animal to be shifted over in like manner, and so on until the whole have been attended to. The spare stalls should be evenly divided, and the men told off into corresponding squads under a non-commissioned officer. After the animals are cleaned, water, and feed with mash. Time 10 A.M. to 12-30 A.M.

After dinner the men should turn down and feed with hay for one hour.

Evening Stables.—Sweep up and rake out stalls to the rear, sponge nostrils, &c., as before. Water and feed with mash. The stablemen to feed with remaining portion of hay. Time, 5-45 to 6-30.

Soon after sunset lamps should be lit, and sentries placed to keep a constant look out amongst the animals, and to report immediately to the officer in charge anything unusual. Both by day and night no men should be allowed to remain below but those who are actually at work.

After the transports have been engaged and fitted, an inspection of each ship is made by a Committee composed of 2 Naval Officers, 1 Military Staff Officer, and 1 Military Officer (not under the rank of Captain). The board should be accompanied by the Senior Medical Officer of the Station and the Surgeon of the troops to be embarked, also by a Veterinary Surgeon in horse transports.

It would appear a desirable arrangement abroad, where much of the work which is undertaken by the Admiralty at home has to be attended to by the military, to detail an officer from each regiment embarking, for duty on each transport as soon as it is reported ready to receive the stores. These officers should ascertain if the fittings are properly arranged, strong and in good order; the quantity of water, rations, and forage put on board; also where the heavy baggage, camp equipage, stores, and ammunition are stowed. He should report to the Quartermaster-General or Embarkation Officer the daily progress towards completion, and if he considers anything is wrong, or is susceptible of improvement. It must be borne in mind that in foreign countries the difficulties of an embarkation are increased by the difference in the language, the want of proper embarking docks, and the absence of the best appliances for loading ships, at times, anchored a long way out in the offing. It is therefore more than ever necessary to guard against mistakes and confusion.

The plan just advocated, of detailing an officer to superintend the loading of each transport, will hasten the work. Barges loaded with different descriptions of stores, or with stores for several ships, can go alongside each transport, the officer on board taking out of it as many bags, bales, casks, &c., as have been detailed for his ship (which

information he would receive from a non-commissioned officer or clerk accompanying each barge). This arrangement would lead to a saving of time, inasmuch as useless trips backwards and forwards from the ships to the shore would be avoided. The stores should be sent in the order they are to be stowed away, the first wanted, or those required for the voyage, being sent always last.* Stores for the same department should be embarked in the same ship. A register of stores put on board of each ship should be kept, lists of all articles embarked being furnished by each department.

Where the Commissariat acts at all independently of the general staff, confusion is sure to arise. The General cannot find out the stores embarked, and the state of readiness of each ship, unless his immediate staff, the one that works out the entire details of the movement, are acquainted with everything that is done. The duties of the Quartermaster-General, the officer who under the General is responsible for the entire movement of the troops, must naturally somewhat encroach on the Commissariat, and without complete harmony between the two, it is useless to expect to carry out a rapid and satisfactory embarkation, as the Quartermaster-General's orders, and consequently the movement of the troops, depend on the state of readiness of the ships. The Commissariat has one important duty to perform, namely, the provisioning, when not done by Admiralty arrangement; but the Quartermaster-General has the moving of the troops on board, and he must be sure that this is not done before proper means for their subsistence have been stowed away, hence his arrangements are partly dependent on the action of the Commissariat.

Ships chartered for the transport of troops should be stowed by the masters, always, however, in conjunction either with the officer of the department concerned, or with those on duty in each ship, whose care it will be to see that in stowing the articles they are put successively away with due regard to the rotation in which they will be again required. The destination of all articles having once been fixed, it should not be altered from one ship to another, if possible, as this would only lead to confusion later on. Ships laden with stores only, should be consigned to the heads of those departments for whom the stores are intended, being landed on requisition by the consignee. The masters of transport ships should be held responsible for the custody and expenditure of the provisions and stores embarked for consumption during the voyage, receiving indents for the daily issues for the gross quantity of each article. Commanding officers are answerable for the correctness of the gross quantity indented, for the proper distribution of which a trusty person must be detailed by them. Likewise with medical comforts, the issues will be in accordance with requisitions furnished by the officer in medical charge of the troops. *

Before a transport is permitted to proceed to sea, a final inspection is held at the last port at which troops embark, and as soon as possible after they are on board. The duty is performed by a committee composed as follows:—

2 Naval officers.

1 Military Field Officer (not belonging to the corps embarked).

1 Military officer (not under the rank of captain).

1 Military Medical Officer (not in medical charge of the troops embarked) who will express his opinion as to the sanitary arrangements of the ship.

The Commanding Officer of the troops embarked is to be requested to accompany the Committee.

* Stores for use on the voyage, on landing, and after landing, should be marked 1, 2, 3, respectively; this will facilitate their proper stowage on board.

In every case where a large expedition of troops by sea is fitted out, a naval officer is appointed as transport agent to control the transport service afloat. If the number of ships be large, he will need the assistance of some subordinate transport agents, secretaries, assistant secretaries, and writers. All transports are given over into this officer's charge as soon as they are ready to put to sea. The charter parties being so worded as to give him complete control over the masters of the transports. The transport agent should be furnished with a copy of all charter parties, description of vessels, number of crew, names of masters and owners of each, copy of bill of lading, and sailing orders. His duties are to make himself acquainted with the terms of engagement of all hired ships, to look after their efficiency, with due regard, however, to economy, and in concurrence with the officer commanding the troops, under instructions received from home, arranging for the discharge of particular ships when their services can be dispensed with. The coaling arrangements are, generally speaking, also part of his charge.

A seaport town of some importance with a good sheltered harbour, spacious warehouses and buildings, convenient wharfs and jetties, &c., such as a Commander would generally select for the debarkation of his army, is as a rule protected by powerful batteries, and holds ordinarily a garrison of sufficient strength for its defence. Where it is deemed inexpedient to reduce a place of this kind before disembarking the troops, a Commander must rest satisfied either with seizing a place of little importance, wanting in most of those conveniences so necessary for the orderly landing of a considerable force, or with effecting a descent on the open beach.

A debarkation in the face of an enemy or of a superior entrenched force, being a tactical operation, it would be beyond our purpose to consider how it should be carried out; we may content ourselves with remarking only on unopposed debarkations, either effected in a harbour or on the open beach. Those effected in the first must be carried out with due consideration of the existing commodities; however, if the precaution has been observed of providing materials for running up temporary piers, &c., the debarkation can be considerably expedited. In landing on the open beach the operation should be carried out on an extended front, to ensure the simultaneous landing of as large a body as possible. If the country is new and comparatively little of it is known, as was the case in the Abyssinian expedition, it will be essential to send in advance a reconnoitring party, composed of one officer in charge, one or more officers of the Quarter-Master General's Staff, Royal Engineers, Royal Navy, Medical, and Commissariat Departments, with interpreters and a sufficient escort, to select a good landing place, with plenty of ground about it, where a suitable base can be established, and where a good extent of shore will permit of the debarkation being carried out simultaneously in various places.

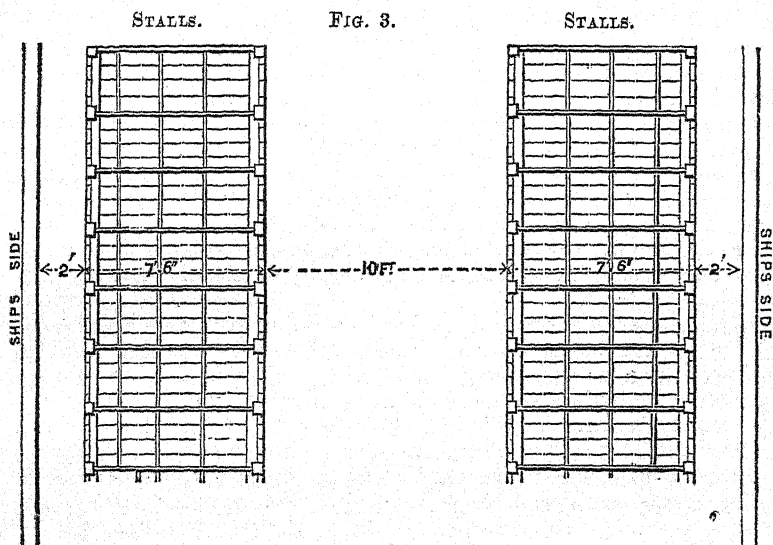
As a rule troops should not be kept on board longer than it is actually necessary. Cavalry and transport being difficult to re-embark, should never be landed until the infantry have secured a proper footing at the place of debarkation. On arrival at the port or other place of debarkation, when the troops are ordered to land, the reverse of the method adopted in embarking should be carried out. The soldiers or drivers take their arms, kits, saddlery and harness out first, then the wagons or carriages, lastly the horses, which will be slung on shore, or on to boats prepared for their reception. On a surly coast this point demands considerable attention, and proper surf boats must be provided to guard against accidents.* The Senior Officer should remain

* At Durban, during the Zulu war, horses were placed in a lighter prepared with sand in the hold; the lighter was battened down and taken over the bar.

on board to see that everything is cleared off the ship, the next senior superintending the landing, getting the animals saddled, harnessed, and hooked in, ready to move off without delay, for it will always be desirable to clear the landing place as soon as possible. Great order and regularity should be observed in landing to avoid the confusion which will be sure to arise otherwise. The saddles, harness, and carriages once on shore should be collected separately by squads, and the animals moved to them, as soon as landed, the soldiers and drivers losing no time in saddling and harnessing, which should be done without noise. When the troops are ready the commander should march them off to their encamping ground, or other locality detailed for them by the debarkation officer.

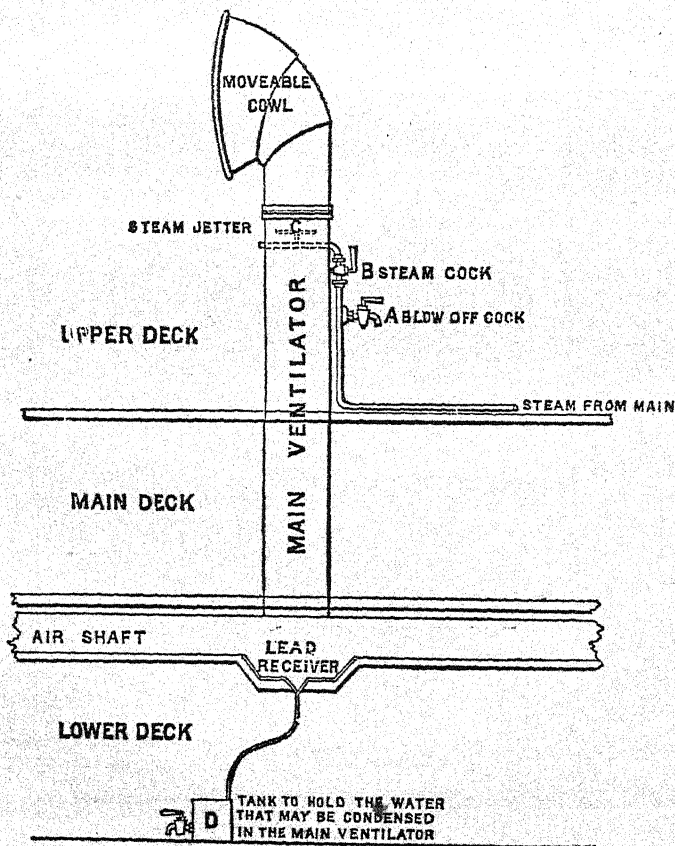
Except in very short voyages, horses and transport animals should not be worked immediately after landing for they are not then in a fit condition to work, and time should be allowed them to recover from the effects of the sea voyage. After a month's voyage horses will need 8 or 10 days' rest with light exercise before being put to heavy work. As they should be kept on board as short a time as possible, all delays in transit will lengthen the time needed for their recovery, on that account coaling on the way should, if possible, be avoided. On long voyages the space occupied by the animals, and by the large quantity of forage required, will sometimes prevent sufficient coals being carried; the coaling arrangements should then be so perfect as to have it done in the shortest space of time.

On the completion of the Zulu war, several complaints were received to the effect that the troops had been embarked without returns, nominal rolls, and other documents, and with no spare clothing, or even sufficient kit; that the stores for consumption had been mixed with the camp equipage and ship's stores, and, in short, that the embarkation was carried out very hurriedly. With the heavy pressure of work at a port like Durban, with ships lying outside the bar, with detachments of invalids, and others coming from various field hospitals and depôts, and also owing to circumstances having detached the men from their kits and supplies of stores, a good deal of this was undoubtedly unavoidable. The staff, however, at the port of embarkation are responsible that every possible measure is taken to provide against this, to secure comfort to the troops on board after hard service, and to facilitate their disposal on arrival at home. The precaution of embarking in some handy place spare clothing to wear on suddenly emerging into cold weather, should never be omitted when troops return from a warm climate; the absence of such a precaution has been the cause of much distress and sickness



DISTRIBUTION OF THE SPACE IN A VESSEL OF 30 FEET BEAM WHEN
FITTED WITH STALLS FOR HORSES.

FIG. 4.



CHAPTER VII.

TRANSPORT OF SICK AND WOUNDED.

THE COMMANDER OF AN ARMY HAS TO ATTEND TO THE HEALTH OF THE TROOPS—TRANSPORT OF SICK AND WOUNDED IN CHARGE OF THE LINE OF COMMUNICATION SERVICE—EARLY APPEARANCE OF SICKNESS IN AN ARMY IN THE FIELD—DR. MORACHE'S REMARKS ON OVERCROWDING—RAILWAYS FACILITATE THE SPREADING OF THE SICK AND WOUNDED—THEIR CLASSIFICATION FOR PURPOSES OF REMOVAL—AMOUNT OF TRANSPORT REQUIRED—NUMBER OF PATIENTS THAT REQUIRE TO BE CARRIED IN A RECUMBENT POSITION—RAILWAY AMBULANCE TRAINS—FITTINGS USED—ACCESSORIES IN PERSONNEL AND MATERIEL—ARRANGEMENT OF CARRIAGES—AMELIORATION OF CONDITION OF SICK AND WOUNDED IN WAR DUE TO THE PUBLIC PRESS—HOSPITAL SHIPS IN THE ABYSSINIAN AND GOLD COAST EXPEDITIONS—AMBULANCE WAGONS, PACK ANIMALS, COUNTRY CARTS, CARRIERS—GERMAN ARRANGEMENTS FOR FIELD LAZARETS—SICK BEARERS—STRETCHERS—GENEVA AND OTHER CHARITABLE SOCIETIES—GERMAN REST-HOUSES.

The Commander of an army should pay every attention to the health of the troops. In this he should follow the example set by the Duke of Wellington, who was unremitting in his attention to all that concerned the health of his soldiers. Had no other consideration impressed on that great commander the necessity for doing so, the serious difficulty in replacing the soldiers incapacitated for duty through disease would have undoubtedly sufficed.

As a very considerable portion of the transport of an army is devoted to the removal of the sick and wounded, a work on military transport would be incomplete unless it treated to a certain extent on this portion of the transport. Medical transport differs greatly from the rest of the army transport, inasmuch as it requires to be of a particular description, and worked under special conditions. As it is mainly employed on the line of communications, it will be considered here especially in relation to the staff of that service.

Under the direction of the Inspector-General of the Line of Communications, a Surgeon-General supervises all the hospital arrangements at the base and on the line of communications, together with the removal of the sick and wounded.* The medical officers should have the direction of all that concerns the medical service in war, but they must recognize the Inspector-General of Communications as the director of the whole service of the communications, of which the medical only forms a part. The Inspector-General should afford them all reasonable latitude in their special branch, not forgetting, however, that perfect harmony amongst all the branches of the service is of paramount importance to an army.

An army no sooner commences to move than its numerical strength undergoes a sensible reduction by a number of men falling sick. Although none but healthy men are generally permitted to accompany an army, and searching medical inspections are held to detect all sickly men, and those of insufficient physique or age,† still there are a

* The detail of the administrative medical staff at page 38 of the Regulations for the Organization of the Line of Communications is on too large a scale for our small wars.

† If the soldiers are too young, the hospitals will soon get filled with sick. None under 20 years of age should be allowed to go on service.

vast number of men who, though apparently in robust health, have in reality weak constitutions, and are unfitted for any heavy exertion; men on whom fatigue, carrying a heavy weight on long marches, amongst clouds of dust and under a burning sun, irregularity in feeding, exposure at night or to bad weather, mental strain, &c., soon brings on sickness. Many men commence a march not in a good state of health, the germs of disease are in them, their ailments may be slight and would not show in quarters for some time, but, aggravated by exposure or fatigue, soon come to the surface. Depression of spirits caused by separation from friends and people is another source of sickness amongst men. In many, a strong desire to do their duty even aggravates their ailments, for they represent themselves to be in better health than they actually are, not wishing to give in and go to hospital, until, when at last they are compelled to do so, their cases have taken a serious turn.

The work of the medical officers, therefore, commences the moment the troops begin marching, and will increase independent of the actual fighting, if hot or wet weather ensues, if the army becomes stationary, or if the distributions become irregular. In a campaign, the proportion of men lost by sickness, owing to their defective constitution, is infinitely greater than that destroyed by the enemy's fire. In our expeditions, particularly, the losses are more due to climate, exposure, fatigue, and want of proper supplies, than to encounters with the enemy. In these the principal causes of sickness are the very considerable difference of temperature between the day and the night, drinking impure water, monotony of food, want of rest, exposure to the rays of the sun by day or to heavy dews by night, lying on damp ground, breathing pestilential air, &c. A good deal of the sickness may be reduced by paying proper attention to the hygienic requirements of an army; for example, the clothing of the troops exercises a great influence on their health, therefore, how they are to be clothed should be well considered, the covering of the feet and head being principally attended to; flannel should be used next to the skin; a waist cloth or *cummerbund* is acknowledged now to be good both in winter and in summer to keep the abdomen warm, a precaution which will save a good deal of sickness. As the clothing has much to do with preserving the health, it should always be suitable to climate and season. If light clothing is used by day, and the temperature varies considerably by night, on the approach of twilight heavier clothing should be put on, and the men should parade in it to see that this is attended to. Besides the clothing, proper attention to the food and manner of cooking it, will lessen the admissions into hospital. In equipping an expedition, and preparing the necessary medicines, surgical instruments, tents, huts, carriage for the sick, medical comforts, &c., the medical staff must study carefully the peculiarities of the country about to be entered.

Regarding the sickness in an army, and one of its most fertile causes, we borrow the words of Dr. Morache, Surgeon in the French Army, from an article published in the *Journal des Sciences Militaires* :—

"From the moment an army enters on a campaign, before the first shot is fired, the sick are not slow in appearing; these are all those whose first fatigues are on the point of endangering their health for a time, who are not robust enough to follow that active life with which most are not as yet acquainted; these first ailments are not in general very serious; a few days of rest, the stimulating influence that the desire to do his duty exercises on the soldier, the example of his comrades, are often quite enough to re-establish men whose eagerness has been betrayed by their strength.

"Nevertheless, by degrees more serious ailments are seen to appear;

the emanations from the ground, the prolonged action of heat and cold, begin to tell on the troops, and, with apparently the most fortunate circumstances for a campaign, without the least epidemic, the army suffers severe losses, and the ambulances* and hospitals are rapidly filled with sick. If the campaign with its variable fortunes is prolonged, if the troops are compelled to remain for a long time stationary on the same ground, if the material conditions of existence become more difficult, the surgeon must expect to see the germs of epidemics derived from the locality (dysentery, typhoid fever, typhus, &c.), or sometimes brought from distant places (cholera, smallpox, &c.), commence to spread.

"The example of ancient and modern wars clearly demonstrates that the losses of an army are much greater from sickness than from the effects of firearms.† In the Crimea, of 95,000 dead we reckoned 70,000 by sickness (typhus, scurvy, cholera, &c.). In Italy, as fortunate a campaign as ever was, and carried out under the most favourable circumstances, the army lost 5,498 men, of which 2,500 by sickness. The returns of the campaign of 1870-71 are not as yet completely published, it is therefore premature to quote isolated statistics relating to particular cases, but the impression which we have all been able to form is essentially in keeping with this fact. The German army has only yet furnished partial results, from which we can nevertheless conclude that it has not been more favoured than ours; however bloody the battles have been, the two armies have lost much more from sickness than from firearms.

"We have no desire to dwell on these data further than to inquire into their causes; these have been cleverly demonstrated by sharp observers; we do not desire more than to derive a lesson from them, namely, that an army on entering on a campaign must prepare its means of assistance, not only with a view to the eventual number of its wounded, a number that one can sometimes approximately foresee, but with a view to the number of sick which it will fatally have, and on the quantity of which it is difficult to speculate. If the hygienist can often foretell the approach of an epidemic, it is not the same with regard to its intensity, which varies essentially according to the locality, the seasons, and the material and moral conditions.

"When to the permanent morbid causes which chastise an army are added, all of a sudden, the numerous wounded which are the outcome of combats repeated at short intervals one after the other, it is easy to understand that, however numerous the ambulances may be, and however well the hospitals and means for relief may have been organized, overcrowding must necessarily be found to arise.

"This word overcrowding to many simply conveys the idea of a large agglomeration of individuals, but for the hygienist, and particularly for the surgeon, it is synonymous to the most terrible plague that can possibly fall on a gathering of sick. Man, even in good health, cannot, without running some serious risks, live a long time confined with his fellows, the barracks, the prisons, over-crowded habitations, are a clear proof of this; the air soon becomes impregnated with injurious elements, the existence of which have been clearly demonstrated, and which constitute the human miasma, but when the individuals thus

* The French apply the word ambulance to small field hospitals and not merely to the carriages for the conveyance of the sick as we do.

† Dr. Serive says on this subject that the "loss produced by the most deadly battles, does not equal one-quarter of the total loss which an army generally sustains." Statistics show that in armies in the field there are from 35 to 40 deaths by sickness to 10 deaths caused by wounds. In sieges or in places besieged, the number of sick rises from 25 to 30 per cent. of the troops.

gathered together are sick or wounded, the air is not slow in acquiring poisonous properties, the action of which are only but too rapid. Who speaks of overcrowding in an hospital or ambulance, speaks likewise of colourless sores with no tendency to heal, erysipelas, hospital putrefaction, mattery infection; under these conditions there is no chance for surgery or medicine, the best conducted operations lead fatally to a sad termination; sores very slight at first become complicated with qualities as rapid as they are inexorable.

"Recent discussions at the Medical Academy, in scientific societies, and in the press, added to the very clear impressions that surgeons gather from their daily experience, show that the influence of overcrowding declares itself the moment a certain number of sick are collected in the same locality. It is in vain that attempts are made to maintain the air pure by means of all the disinfecting processes afforded to us by chemistry, it is in vain that the ventilating appliances are improved, the pathologic encumbering is produced in those establishments apparently best fitted for their destination as hospitals. Thus the physician judges of the existence of overcrowding not by the amount of cubic feet of air allowed to each patient, but on the progress made by diseases or wounds, and rarely finds himself agreeing with the administrative officers who cannot master the situation as correctly as he can.

"If in our regular hospitals, removed from all specially serious conditions, we often observe the phenomenon of overcrowding survene, how much more are we to expect it in these ambulances continually increasing in the wake of an army, round about a battle-field. It appears as if all the most disastrous conditions took a pleasure in gathering together, large multitudes of wounded, insufficient space to hold them,* means of aid and *personnel* always out of proportion with the requirements, exhaustion of the wounded caused both by the hardships of the campaign and by those of the engagement, and lastly the vicinity of the battle-field with its pestilential emanations. Soon one or the other army has been obliged to fill all the dwellings in the villages, all the clusters of houses with its wounded;† each is thus transformed into a veritable focus of infection,‡ and the entire region becomes, so to say, overcrowded, for a single spot cannot be found where a surgeon can hope for better conditions, or more favourable circumstances for his wounded.

"Such, in a few words, is the picture which the ambulances present always after a battle, a picture, the accuracy of which we have been able once more to verify during the last campaign.

"In this terrible emergency there can only be one plank of safety: the spreading of the sick and wounded as largely as can be done. It is necessary to clear them out with all speed not merely on to the neighbouring towns, but as far as it is possible to considerable distances, because the next engagement may furnish a new contingent of wounded, and cause a renewal of the danger one desires to contend with. If, by

* In a narrative of the winter campaign in Bulgaria, by a Russian Medical Officer, attached to a battalion of the rifles of the guard, the writer shows how one of the hospitals fitted for 60 men was before long occupied by 1,000. On arriving at San Stefano he found three hospitals, originally intended to accommodate 600 men each. Each one was overcrowded, and filled with from 1,500 to 2,000 cases, while in each ambulance, designed to hold 85 patients, between 800 and 1,000 were packed.—G.A.F.

† Five days after the battle of Sadowa had been fought there was not a village within the circumference of 4 leagues that was not filled with wounded.—G.A.F.

‡ Epidemics which emanate from a large number of military sick and wounded have been known to linger for years among the civil population in the districts over which they were dispersed.—(From an article in the "Gentleman's Magazine" August 1879.)

the nature of its operations, the army remains stationary, as, for example, during a siege, this necessity is perhaps even more marked, as from the very fact of its immobility, it has not long to wait to see epidemics break out. Such has been during the recent campaign the history of the German Army round Metz and round Paris; notwithstanding all the precautions taken with that regularity, that method, and that intelligent care of the soldier, which do so much honour to the Germans, their army has felt severe losses from dysentery and typhoid fever (*typhus abdominalis*).

"This experience had been ours long ago; our army has experienced the same phenomena in the Crimea; it is true these became more complicated on account of the exhaustion of the soldiers, and the want of sufficient hygienic means to place them in a state to contend against morbid influences.

"The spreading of the sick and wounded is important for them for more than one reason; it tends essentially to place them in more favourable conditions towards their cure; removed from the theatre of operations, they can be admitted into regular hospitals, fully provided with *personnel* and *matériel*, whereas in the ambulances, all the resources are precarious; in far away hospitals the surgeons, finding themselves in more normal conditions, having at their disposal those complete appliances which can only with difficulty find a place in the ambulances, will be free to act calmly, to attempt the *preserving* surgery which is too often impracticable in the field; in one word, the spreading permits of the rules of modern medicine being applied to the wounded which looks upon hygiene as the most indispensable of her means of action. The spreading of the sick is also important for the rest of the army, for the able soldier; it is not good that he should keep under his eyes the sad sight which the ambulances present some time even after an action; the soldier must feel sure that sick or wounded he will receive the care that his state calls for, but his imagination must not be allowed to be shocked by the sight of the sufferings of his comrades; if possible he should only see the glory of the engagement and carry away the legitimate pride of an accomplished duty."

Here we come to the part which affects the line of communication staff, the considerations—first, of the means for effecting this very necessary removal and spreading of the sick and wounded; secondly, the accommodation necessary for them in transit, and in temporary hospitals before their ultimate disposal. The spreading of the sick and wounded is acknowledged to be of primary importance to an army, and this demands proper establishments along the line of communications to the base, and thence to one's own country. These establishments must be connected by a sufficient system of transport.

The only efficient system is one that provides for a continual stream of patients from front to rear without interruption, for the least interruption will again bring on that accumulation of sufferers which it is so desirable, in the interest of the army and population, to avoid.

The employment of railways in concentrating armies has reduced the rate of sickness caused by the hardships endured in the long continuous marches an army made before coming in contact with the enemy; but, on the other hand, the first few days after the concentration by these means is completed will see a large number of men admitted into hospital, when the army is close to the enemy. As the field army should be always as free as possible of encumbrances, all the sick, with the exception of the very lightest cases, must be removed from the army. The principal duties of the Surgeon-General of the Line of Communications and Base, besides taking complete charge of all the sick and wounded the field army leaves behind in advancing, are to arrange

for the removal of all those that can be safely moved to hospitals in rear, either on the line of communications, or further away to places entirely out of the theatre of war; to prepare suitable accommodation for disabled men coming from the front; to provide for parties of sick and wounded moving by rail, by water, or by other means on ordinary roads; to dispose of the staff of medical officers, army hospital corps, nurses, etc., in the best way, according to circumstances, and the necessities of the moment; and to select spacious well ventilated buildings in healthy localities for conversion into temporary hospitals.

The importance of a proper and sufficient organization of the *personnel* and *matériel* of the medical service in our wars, generally carried out in unhealthy climates, does not require to be mentioned. If much of the success of every campaign depends on the preservation of the health of the troops, how much greater must be the need of providing against the effects of climates so injurious to the constitutions of Europeans. Not only a *personnel* in proportion to the troops for immediate attendance is required, but medical officers for the communication posts and the hospitals both on the line of communications, and at the base. Of the medical *personnel* it will be as well to consider one-tenth generally unavailable through sickness; a reserve therefore will always be needed.

All wounded can be reduced to three classes, the slightly wounded; the severely wounded, who have either to undergo amputations or operations, or whose wounds and fractures will take a long time to heal or set; lastly the desperate cases for whom there is no hope, and all that can be done is to endeavour to alleviate their last sufferings.

Evacuations of sick demand to be effected with judgment not to aggravate the state of the wounded by too early a removal, and on the other hand, not to remove those who in a few days might rejoin their corps. Where there are no suitable means of transport, evacuations of sick and wounded in great numbers will be inexpedient owing to the exposure which the patients would have to endure. Country carts for this purpose are bad, as they afford no protection from cold, wet, and heat, and cause a large amount of suffering from want of good springs to deaden the jolting.

When it is possible to make a proper selection of the patients to be removed, retaining only the most severe cases for local treatment, many lives may be saved. In making a selection, the sick and wounded should be divided into two classes.

1st. Those who should remain in the hospitals on the spot or quite close at hand.

2nd. Those who can be removed to hospitals at a distance.

Under the first head should be included men of three different classes.

(a.) All very serious cases which are likely to be only aggravated by moving.

(b.) All patients suffering from contagious diseases who should not travel, and who should be treated in secluded hospitals.

(c.) Those who have received only slight wounds, or who are suffering under a temporary indisposition, and who will be fit to return to duty in a few days.

Under the second head should be included—

(a.) All those whose recovery will demand a fortnight or more, where no risk is run of aggravating their cases by removal.

(b.) All those who, treated at first on the spot, are found to be in a fair road to recovery, whose cure is considered as near, and who can stand travelling.

Transport, the great difficulty in all wars, makes itself felt amongst other requirements in the medical arrangements, and will be needed on a large scale: the medical transport, however, cannot be improvised, it demands a particular description of *matériel* which has to be prepared before hostilities commence and kept ready to be sent out with the army.

The subjects of the best *matériel* and method for removing the sufferers from the field, the aid to be administered to them in transit, and the system to be followed in clearing the hospitals, by all available means, have been much studied of late years. Thus Baron Percy's brancadiers have been reintroduced; what is accepted as the best known *matériel* for the transport of the sick and wounded (that one, namely, which will secure the greatest ease to the patients, and will not aggravate their injuries) has been adopted; and the improved means of locomotion both by land and water have been turned to account.

Let us now cast a glance at the various means which can be made use of in carrying out the necessary removal of the sick from the hospitals in the vicinity of the battle-field, to spread them over a much larger area in rear. These consist, first of the improved means of locomotion, as railways and steamships; second, the old system of removal by ambulance wagons, country carts, horse and mule litters, etc.; third, and this last we have very often to resort to in our expeditions in India, and in wild countries, by carriers, the sick being accommodated in dhoolies, hammocks, cots, and dhandies.

The amount of carriage required for the removal of the sick and wounded is difficult to estimate. Dr. Gordon considers that transport for wounded in a campaign should be provided for 12 or 15 per cent. Dr. Millangan calculates that at the commencement of an active campaign, one-tenth of the army requires hospital treatment, and one-fifth requires subsequent removal to the rear during its progress. Dr. Longmore calculates transport at the rate of 5 per cent. of the combatant force as required at starting. However, all these and other calculations are only approximate, for the circumstances are always varying, and the only sensible plan is to have a considerable reserve always prepared and ready for use.

To be able to form a pretty accurate estimate of the carriage required for removing the wounded, the average ratio of those requiring to be carried in a recumbent position must be first ascertained. Dr. Longmore shows in his tables, prepared on returns furnished after the Crimean, New Zealand, and American wars, that this average amounted to one out of every three wounded men. From the number of very serious cases picked up on the battle-field, a certain deduction will have to be made for those unfortunates who succumb to their wounds, either on the day of the battle, or on the few following days; but, on the other hand, provision will have also to be made for the removal of the wounded which the enemy may leave on the field.

Railway Ambulance Trains.

The removal of the sick and wounded in rear of the field-army belongs, as we have observed, to the service of the line of communications. It being above all necessary to avoid the evils likely to arise from the collections of large numbers of sick and wounded, means must be provided for a judicious evacuation of the field and temporary hospitals. One of the principal aims in organizing a proper

communication service is to civilize war by limiting its evils. Where railways are available, the removal of the sufferers by their means is one way of carrying out this idea. Did railways offer us in war no other advantage but improved means for removing a large number of sick speedily, with ease and comfort, this of itself alone would be a great boon. The spreading of the sick over a large tract of country where a railway is at hand becomes possible, they need no longer be massed in large numbers in crowded and pestilential hospitals, and, being subdivided into small groups, miles away from the front, can be better cared for, whilst civil practitioners can be called to their aid, leaving the military medical officers free to remain with the field-army. The neighbourhood of an army will not be encumbered with a large number of hospitals, for five or six hours by rail, a long enough journey for sick people, will, if a railway is used, place all the slighter cases about 80 miles from the battle-field the same day as a battle has been fought, leaving a larger number of medical officers to look after the most serious cases. A further advantage obtained by the use of railways for the transport of wounded men is their conveying them at once to fixed hospitals in the rear, from which they will not have to be moved shortly after the performance of some serious operation. Experience has now clearly proved that evacuations of wounded on a large-scale can only be properly effected when transport by rail is available; that railways only can obtain for us the necessary spreading of the sick and wounded, and that by a good organization this can be so carried out as to make the journey a period of repose, from which the physical and moral strength of the patients will be greatly improved.

The transport of sick by rail is affected by means of special ambulance trains prepared and affected to that purpose entirely.

Ambulance trains should be considered under the following heads:—choice of rolling stock; fittings and mode of suspension of beds, stretchers, etc.; ventilating and lighting; composition of the train, number of sick carriages, accessory wagons, and consecutive order of the same in each train; *personnel* required for the medical service; stores, medicaments, comforts, and supplies; length of journey and rate of speed. It has been thought desirable to separate the railway transport of the sick and wounded from the chapter on railways in general, as a separate study should be made of this branch of railway transport.

The cases of sickness in an army in the field are far in excess of wounds, in the proportion of 10 to 1. The principal causes of sickness are due to malarious influences, and comprise low and eruptive fevers, typhoid, liver, dysentery, diarrhoea, etc. The separation of the sick from the healthy, as a preventive to the spread of sickness, being a very important matter for the military hygienist, he must have the means for removing them, and, where railways are used, to prevent the spread of infectious diseases the rolling stock affected to this service should be kept exclusively for this purpose, the carriages being disinfected by sulphur after each journey. The carriages should be plain with nothing about them that may retain the seeds of contagion, or prevent their being thoroughly cleansed and purified. Carriages that have conveyed serious cases should not be used for either troops or passengers, for seriously wounded cases have all more or less a tendency to gangrene, unless when the wounds are quite fresh. The sick trains should move independently of other trains, and as slowly as can be conveniently done.

To keep a large number of special carriages for this purpose would be a waste of rolling stock; certain carriages and wagons should in

preference be converted and suitably fitted when the time comes for establishing the ambulance trains; carriages with this idea can be so constructed as to have their interior fittings quickly removed, and replaced by proper ones suited for the transport of the patients. The Knights of Malta have a fine ambulance train stored at Strakonitz, in Bohemia, and their staff receives a certain yearly training. With the menacing standing armies kept now on the Continent, a war may break out at a very short notice, hence the Red Cross Societies may consider it important to have means ready for any sudden contingency that may arise. On the Continent, besides, the chances of war are with neighbouring States only; the conditions with us are different, on account of our colonial possessions, we are liable to have to take the field anywhere in any part of the world, keeping, therefore, an ambulance train, except as a model, would be of no use for us.

A large number of railway ambulance wagons have been constructed; however, the difference in the construction of the various railway lines now in use in the various States, often precludes the adoption of the several patterns. To give an example, the best ambulance carriage is undoubtedly a long one, but the same length of carriage is not equally applicable to all lines, as those in which the curves have a short radius demand shorter wagons and carriages than other lines; the same likewise applies to the rolling stock of all lines where the speed is great. In a thorough study of this subject it is necessary to consider both the carriages built purposely for the conveyance of the sick, and all proposed methods of conversion which can be used in their stead. Special ambulance carriages are costly, and it would not be prudent to compel railway companies to keep in hand a large stock of carriages which could be put to any other use. To keep only a few, unless kept as a pattern, would be of no avail either, for in war a large number are needed. The best plan would be to have a model both of an approved ambulance carriage, constructed specially for that purpose, and of one showing the best way in which the usual rolling stock can be readily altered and made suitable for the transport of the sick.

The first attempts to utilize railways for the transport of sick and wounded were very crude; the patients were laid simply on a litter of straw on the bottom of covered goods wagons, the straw, which was insufficient to deaden the shocks or trembling motion of the train, soon got displaced and caused suffering to the patients. The doctors and attendants had also to kneel down to attend to the patients, which was a serious inconvenience. Experiments were tried with mattresses laid on the floor of the wagons, and others laid on trusses of straw; these were but slight improvements. General Sherman, in his account of the Atlanta campaign, says: "For sick and wounded, box cars filled with straw or bushes were usually employed." Other experiments were made with hammocks, but these resulted in showing how utterly unsuited hammocks were for the transport of serious cases, the curved position of the patient, and the continuous swinging motion, added greatly to his sufferings, and made it impossible for the doctors or assistants to render them the necessary assistance.

The principal aim of all railway ambulance wagons is to obtain for the sufferers the greatest possible amount of comfort during removal, guarding as much as possible against their being discomforted by the continuous shocks and oscillations of the train. This can be only obtained by the use of iron and wooden standards to hold the stretchers (Figs. 5 and 6), of beds resting on laminated springs secured to the carriage floors (Figs. 8 and 9), of stretchers suspended from the roof with spiral springs (Figs. 10, 11, 12), sling ropes (Fig. 13), or caoutchouc rings (Fig. 9), stretchers suspended from

the sides with leather thongs (Fig. 14), swinging cots (Figs. 15 and 15a), rope slings attached to a stout bamboo as at (Fig. 16, 16a and 16b), or attached to a rope and pole combined as in (Fig. 17), and other kinds of contrivances. Some writers assert that rigid support like the American wooden standards are preferable to the employment of ropes, straps, or leather thongs, as these latter add to the existing oscillations; however, in a consideration of the subject, we cannot omit mentioning every contrivance that has been proposed and used. In the first experiments the patients were carried in goods wagons, but these having very stiff springs, and being badly ventilated, required considerable alteration to be adapted for the conveyance of sick and wounded soldiers.

A system is preferred in this kind of railway transport that will permit of the patients being brought into the wagons, conveyed and taken out at the end of the journey on the same stretcher; a measure which will save them, and particularly those wounded in the chest and abdomen, the intense agony which changing from one stretcher to another entails.* We require also the adoption of a *matériel* and fittings which will reduce to a minimum the shocks and oscillations of the carriage, and that will allow of the stretchers or beds being disposed lengthwise, or parallel to the line, an arrangement which will alleviate the suffering of the patients, being the position in which shocks are felt the least. The provision of a free circulation for medical officers and attendants, good ventilation,† good lighting by day and by night, good entrances, etc., are needed; likewise the conveyance of a suitable staff of doctors and attendants with all articles necessary, so that the medical treatment may be continued in transit, special wagons for cooking, fuel, stores, etc. An ambulance train, in short, should be like a ship containing in itself all that will be required in transit: in point of fact, a train of this kind should be nothing more or less than a moving hospital.

Medical officers have a just claim to direct every establishment connected with the treatment of the sick, they being fully cognizant of the technical requirements of a service whose sole aim is to cure sufferers from sickness or wounds. A medical officer should therefore be in sole charge of every ambulance train, for he will be the best judge of what sick can be safely conveyed, he can best distribute them in the carriages with reference to their cases, and can regulate them according as it becomes necessary in transit. No persons should be employed in these trains but those who possess a fair knowledge of the cares to be bestowed on the sick and wounded, all people who do not possess this knowledge can only be in the way; even the employment of female nurses appears to be objected to, medical officers recommending their employment to be restricted entirely to fixed hospitals.‡

The arrangements for the removal of the sick by rail, or by other means, come within the province of the Surgeon-General of the line of communications. Being in telegraphic communication with the medical officers in charge of hospitals, who from time to time will report the number of patients in their charge, showing the number whose

* The travelling stretcher should be wider than the ordinary field one for comfort, but the last should be used whenever the shifting of the patients would be attended with increased suffering.

† Roof lights are admirably adapted for lighting and ventilation.

‡ During the Russo-Turkish War of 1876-77, female students from a branch annexed to the Medico-Chirurgical Academy at St. Petersburg, volunteered their services; these were accepted and the students ranked under the Red Cross. They worked in the hospitals as female doctors.

FIG. 5.

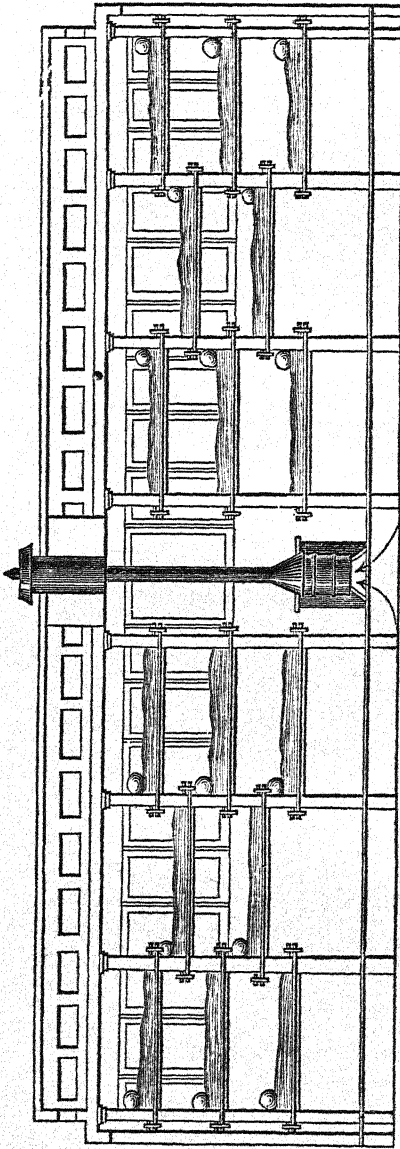


FIG. 6.

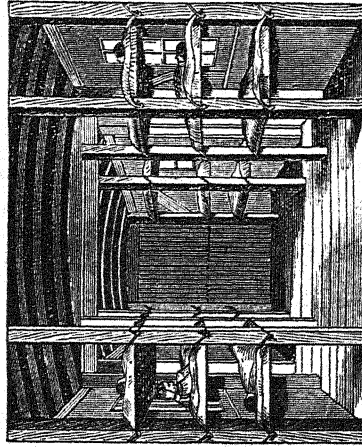


FIG. 7.

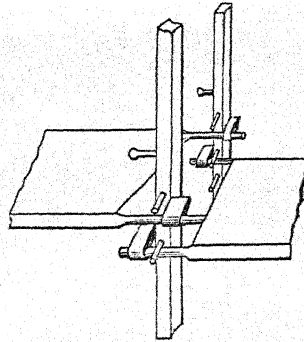


FIG. 7a.

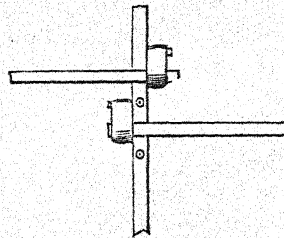


FIG. 8.

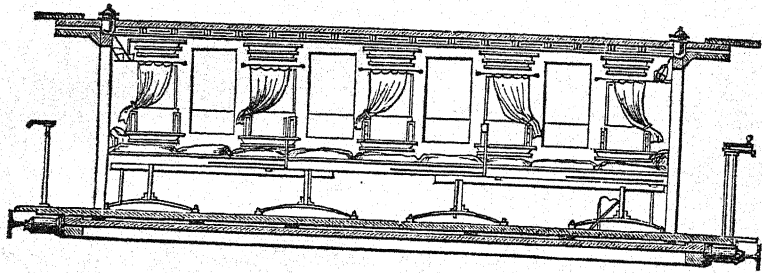


FIG. 9.

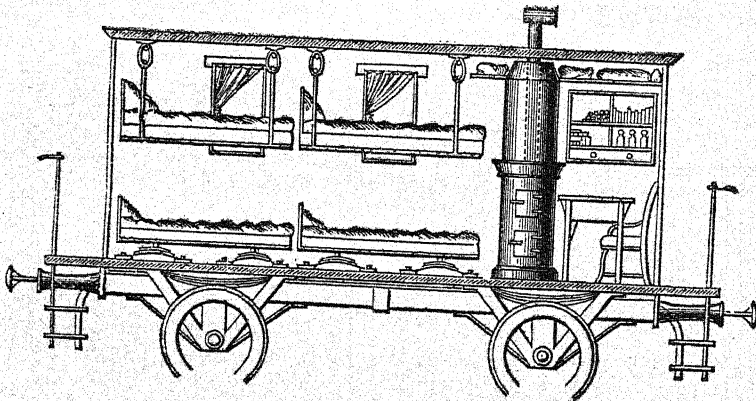


FIG. 10.

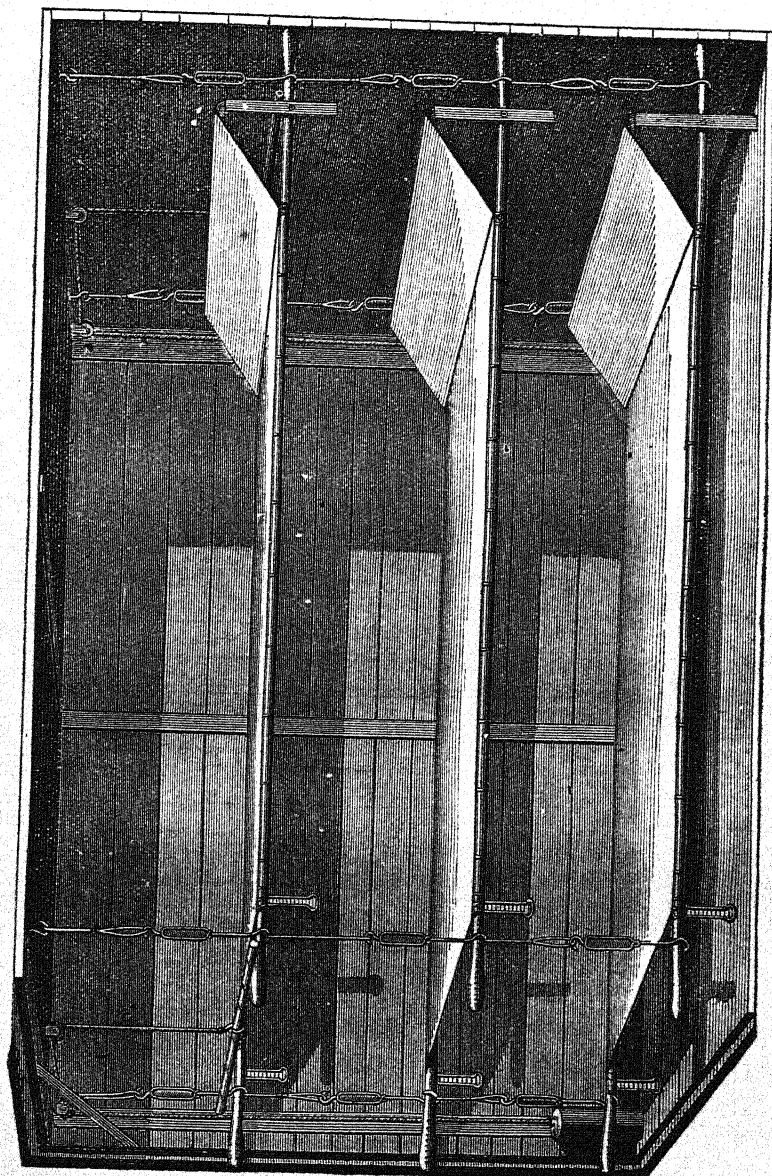


FIG. 11.

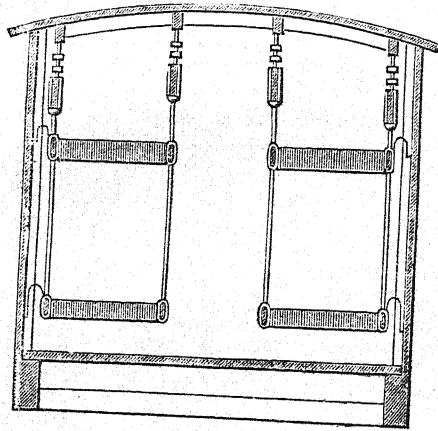


FIG. 12.

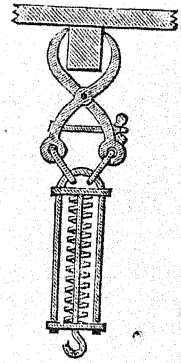


FIG 14.



FIG. 15.

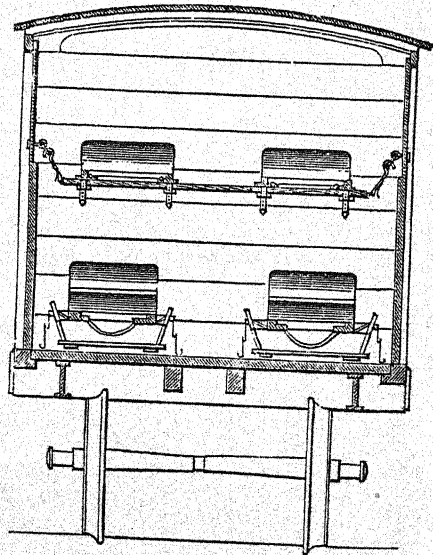


FIG. 13.

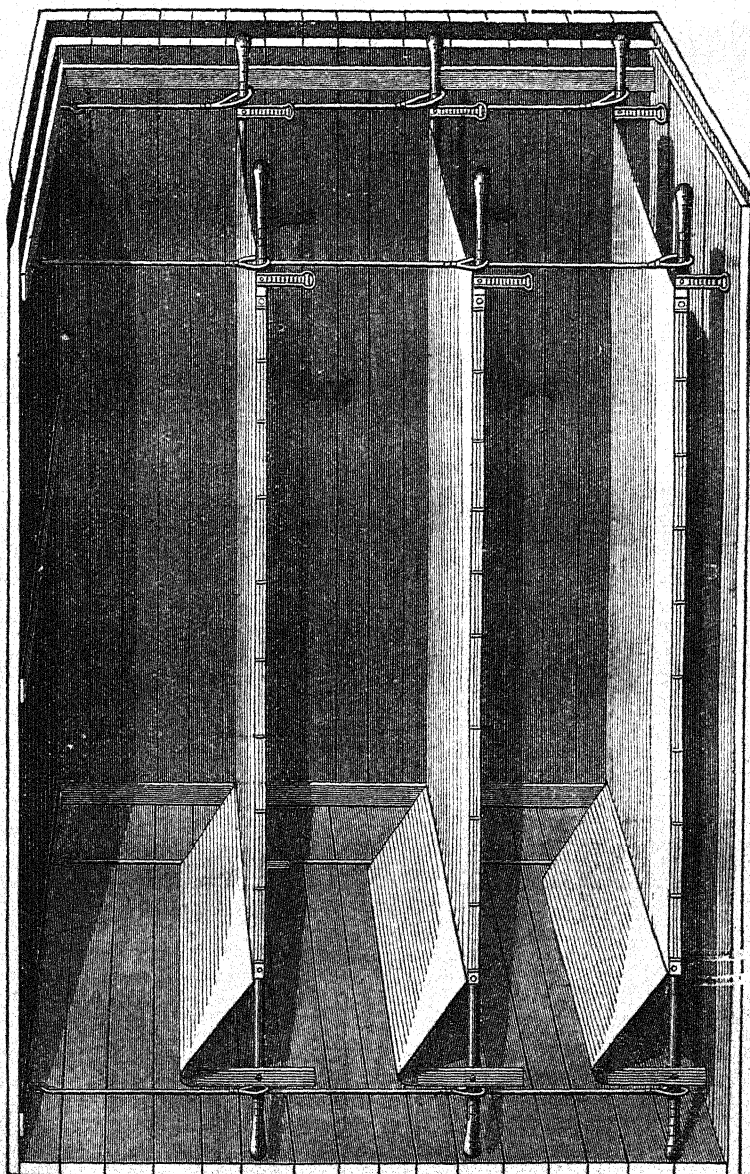


FIG. 15a.

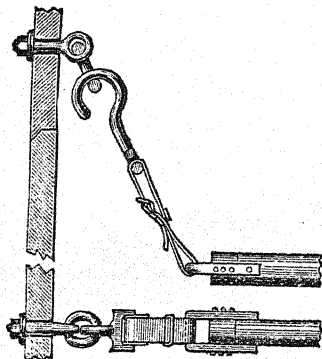


FIG. 17.

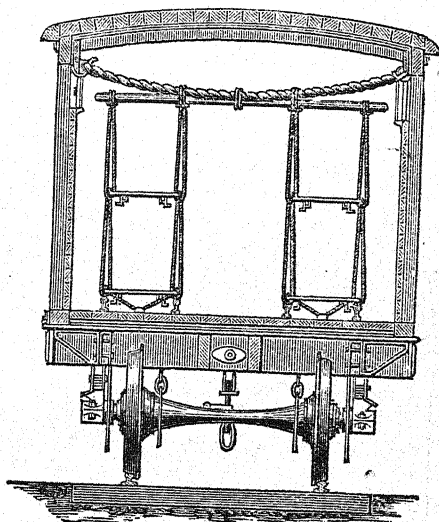


FIG. 16b.

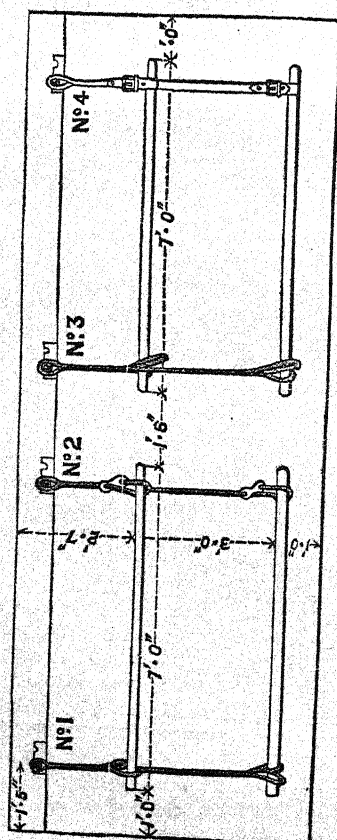


FIG. 16.

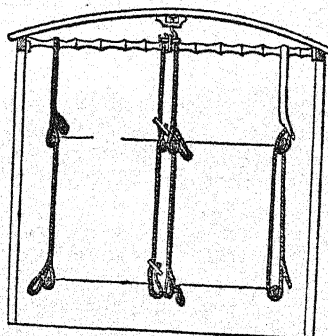
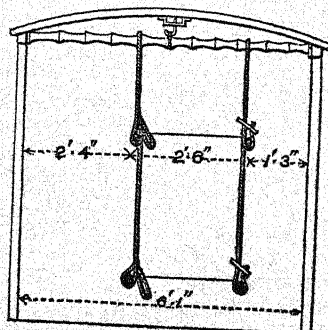


FIG. 16a.



removal can be attended without danger, he will be aware of the number ready for removal, and of these also of the number that require to be carried in a recumbent position. He will then be able to inform the line of communications staff of the number and description of carriages required, of the locality where the trains should proceed to pick up the patients, and of their ultimate destination. No one should have any authority to interfere with the movement of ambulance trains in transit to their destination, unless circumstances should make it dangerous for these to proceed. The carriages used in these trains should be painted in some suitable colour to distinguish them from all other, one that throws off the sun's rays being preferable. Each carriage should bear the Geneva device in some conspicuous place, every train, in addition, mounting the Geneva flag for better protection. The officer in charge should be furnished by the railway military commander at starting with an itinerary showing the route to be followed, stations for stoppage, hours of arrival, length of stoppages, and other necessary details.

First and second class railway carriages can be used for the less badly wounded; battens placed across from one seat to the opposite one will form a comfortable enough seat for slight cases. The carriages need not be kept full to give the patients more room. Some arrangement is desirable for obtaining a free passage from end to end of the train, an arrangement much to be desired even in the ordinary passenger traffic. The patients should be dressed as completely as possible, only divested of those portions of their dress which may prove inconvenient. The packs and effects of the sick, tied up together in bundles and ticketed, should be sent by the same train in the baggage wagons; the arms and accoutrements being delivered over to the Ordnance Store Officer.

Specially constructed or converted ambulance carriages must be prepared for the most serious cases.

In forming ambulance trains three things should be borne in mind. 1st, to use all the available materials; 2nd, lose the least possible time; 3rd, incur the least expenditure. Third class carriages are the best for conversion; if a sufficient number of these carriages, with moveable seats, were kept in use, the removal of the seats would at once offer so many unfurnished carriages, which, with the addition of certain fittings kept in store in peace time, could be quickly transformed into proper ambulance carriages. This was actually done in Germany, where the Wurtemberg 4th class carriages without seats were, in the war of 1870-71, speedily turned into hospital carriages and taken as a pattern for the new constructions. A very important point in every ambulance train is the provision of a free passage, about 3 feet wide, from end to end of the train, to afford free circulation to medical officers and attendants carrying trays and other articles. This can be arranged by having sliding doors at each end of the carriages which, besides securing the free passage above mentioned, will also considerably improve the ventilation of the carriages. Other openings should be provided at the sides for bringing in the patients, for, were they only put in the train by the end doors, the entraining would occupy too long a time. As a rule, the entraining of the patients will generally be done through the side doors, as in this case all the carriages can be filled at the same time. These openings should be sufficiently wide to save the patients from being knocked against the sides, and their sufferings being thus augmented, particularly when entraining by night. The berths should be arranged in tiers for the sake of economising transport. In the Bavarian sick trains in 1870-71, their short carriages only admitted of five patients being carried in each, the beds resting

spimly on laminated springs on the carriage floor. This is a waste of room that should, if possible, be guarded against.

Wooden or iron standards, spring platforms or sling ropes, with or without spiral springs, must be set up to receive the stretchers bearing the patients; the upper tier of stretchers should be provided with waterproof sacking to avoid giving annoyance to the patients in the lower one. It is recommended to have the carriage floors soaked with hot linseed oil, and for the sake of cleanliness not to use a carpet or floor covering of any description. In the Prussian trains during the Franco-German War, the floors were covered with oilcloth, which, during the intense cold weather, was replaced by straw mats.

The berths should all be numbered so that the medical officers when called may have no difficulty in finding their patients, and be able to provide themselves with what each case requires. The occupants of the upper berths can only be thoroughly attended by the aid of some description of portable steps which should be provided. Water-closets must be so constructed as to discharge the evacuations at once, separate ones being reserved for patients suffering from infectious diseases; all should be shut off from the carriages themselves, and a solution of sulphate of iron will be found good in counteracting the smell. Where the patients are mostly carried in a recumbent position, bed pans will have to be principally used. A roof ventilator running the whole length of each carriage offers great advantages, both in lighting the carriages and in keeping the air pure. Warming the carriages in cold weather is a necessity, for which purpose American stoves have been found very suitable. Acoustic signals and electric bells to place the various carriages in communication, to call the medical officers, or to stop the train, are also considered desirable. Each carriage should be provided with a small tank for water.

In 1863, during the American War, the first ambulance trains were started between Fredericksburg and Aquia-Creek. Later on in the same year, the Federal Government having approved of a model wagon for the conveyance of recumbent patients, the ordinary railway wagons, which lent themselves marvellously for the purpose, were converted on this plan. As the American ambulance wagon afterwards served as a model for most of the European sick carriages, a short description of it may not be thought out of place. The American carriages (Fig. 5) are very long and high, and are not like most of our carriages divided into compartments, but are more after our saloon carriages, with seats ranged on each side; a thorough communication from one end of the train to the other exists in the American passenger trains, each carriage having a door at each extremity, and, thus, by means of a small platform or bridge, a traveller can pass safely from one carriage to the next. The seats had therefore only to be removed to obtain a long empty wagon which could be easily fitted up in any way it was desired. A double row of wooden standards (Fig. 6) were put up on each side of the carriage, the same distance apart as the breadth of a stretcher, the handles of the latter being passed through strong india-rubber rings held by substantial pegs fixed in the standards (Figs. 7 and 7a). Each wagon so arranged could hold 32 stretchers, leaving a clear space for medical officers and attendants to move through, for a stove, a few chairs, etc. The Americans made a great use of hospital ships during the war, and their ambulance trains were run close to the ships, the patients being removed on the same stretcher from the field of battle to the train, then from the train to the ship, and finally to their destination. A certain number of medical officers and assistants provided with all necessary articles for dressing wounds, refreshing the

sufferers, &c., were attached to each train, the object being to continue the medical treatment during transit.

The railway carriages, except in America, Switzerland, and some parts of Germany, are too short to accommodate the same number of patients as the above; thus we find in the war of 1870-71 from 14 to 16, the largest number of recumbent patients in each carriage, whilst often 8, and even 5 only, were allotted to one carriage. About 10 sick to each carriage will be found a convenient number. The number of sick trains required can only be determined according to circumstances. The total accommodation provided by the 21 German ambulance trains used in the Franco-German War was estimated at 3,724 places.

The arrangements for sick trains should be prepared beforehand, in peace time, instructions being framed full of details, never mind however minute; nothing should be left to chance, and no pains should be spared in arranging in a most complete way for what will be required, both as regards the *personnel* and the *matériel*, and the rules which should guide the removal of the patients. Money spent in looking after one's own sick and wounded is less thrown away than that spent on any other account in war. Where no pre-arrangements have been made, the time which should be devoted to the disabled must be employed in making arrangements, in seeking the best means for altering *matériel*, &c.: all experiments in war time are dangerous and a waste of time, to bear good fruits the experiments should have been made before the commencement of the war. The expense also, in cases where these arrangements have been neglected in peace time, will be great, for everything will have then to be done, independent of the cost, as the expenditure, whatever it may amount to, cannot then be considered.

Besides the most convenient description of carriages to be used, it must also be considered what will be the most convenient number for each train; what other special carriages will be needed besides ones for the sick; the order in which these should be marshalled; lastly the *personnel* to accompany each train. It is admitted that in these ambulance trains the carriages should not be very numerous; about 24 carriages is considered to be a convenient number for trains that have to travel at the rate of from 25 to 30 miles an hour, and we can accept that number as the limit of carriages for a sick train; however, these 24 carriages are not all for the accommodation of the sick, as about one-fourth of the whole must be deducted, being required for medical officers and attendants, kitchen, fuel, and stores.

As each train requires a surgeon-major with several surgeons, two or three cooks, and each carriage containing sick, an attendant (except for very short journeys,) carriages must be provided for all these, being so arranged that every person may obtain the rest he will be in need of, without being disturbed by his fellows in going to and fro. These carriages must be all furnished with doors at the extremities, so as not to interrupt the free passage from end to end of the train which, as previously stated, is considered so essential.

The special carriages for the *personnel* and *matériel* are as follows:—

A carriage fitted up for the accommodation of four medical officers. A certain degree of comfort should be secured for these officers who have to devote such unremitting attention on the patients. Each officer should have his own cabin, marked on the outside with his name. The cabin will require drawers for the occupant's personal effects, a bed convertible into an arm chair, a writing table hinged to the side to be raised and lowered at pleasure, a chair, a washing apparatus, a looking glass, a few hat pegs and nets for sundries, a small shelf for books, a drawer for instruments, and a timepiece.

The carriages for the attendants should contain places for the safe keeping of their private property, sleeping berths, washing, and necessary apparatus.

A cooking wagon is considered necessary, as it will make a sick train independent of the alimentation procurable at the fixed rest places on the line, and it will make the train more complete and independent; it will besides, which is a great point, diminish the duration of the journey by avoiding protracted stoppages in transit. A serious difficulty in a cooking carriage is the constant oscillation of the carriage, which tends to spill the liquids from their receptacles; on this account a special *matériel* with covers to screw on, or to be retained by nuts is required: some description of apparatus on the principle of a swinging lamp on board ship might be found to answer. Precautions against fire are very necessary in cooking wagons, owing to the material of which they are constructed. As these trains must be composed of as few carriages as possible, a separate wagon for supplies may be dispensed with if drawers for all the articles that are carried, in places where the heat is least likely to affect them, are judiciously provided.

With regard to provisions these are of two kinds, those that can be kept for many days without deteriorating, such as, tea, coffee, chocolate, sugar, barley, semolina, arrowroot, rice, flour, pulses of different kind, preserved potatoes and vegetables, preserved and potted soups and meats, extract of beef, biscuits, preserved milk, oil, etc.; and those which will not keep, such as fresh meat, milk, eggs, butter, bread, vegetables, fruit, etc., which can be obtained in transit from the Commissariat Officers at the communication stations. Spirits and wines must also find a place in the trains, particularly brandy, port wine, beer, porter, with aerated waters and other comforts.

The fuel will need a wagon which should be provided with a clear passage through the centre like the rest of the carriages; it can be divided into three parts, the centre part being kept clear for passage, the two lateral ones to contain the necessary fuel.

In the transport of sick by rail, cooking is done under difficulty, the distribution and consumption of food, particularly soups, beverages, etc., are trying; the medical service, dressings, etc., cannot be either well performed whilst the trains are in motion. All these points tend to show that everything should be arranged as much as possible beforehand, the sick dressed before entraining, the cooking prepared, and so on, before each train starts.

Our space does not permit us to enter into lengthy details of the fittings, or to furnish inventories of the articles necessary for ambulance trains. The communication staff will not have to superintend the preparation of these carriages, a business which must be entrusted entirely to skilful and practised railway carriage builders, all that is needed is that they should be fairly acquainted with the principal requirements of sick trains.

The following composition of one such train, and order of marshalling will be found convenient:—

Engine and tender—

- 1 brake-van.
- 1 carriage for medical officers.
- 1 carriage for attendants.
- 9 sick wagons.
- 1 cooking wagon.
- 1 fuel wagon.
- 9 sick wagons.
- 1 brake-van.

The carriages for the gravest cases should be in the fore-part of the train; the most serious being accommodated in those nearest the centre of the train, where the shocks are felt less than in other parts. Such a train (the carriages being each prepared to receive 10 recumbent patients), would convey 180 sick, for which the following staff and attendants is considered sufficient :—

- 1 Surgeon-Major in charge of the train.
- 3 Surgeons (of which two might be civilians).
- 18 Subordinates, 1 per sick carriage.
- 2 cooks.
- 1 assistant cook.
- 1 clerk.

As a rule, so as not to occupy too much room, the attendants should be as few as possible; one attendant per carriage is considered necessary, and by adding one-third to the above number, the attendants in turn would be secured a certain amount of rest which the constant service will demand. The Medical Staff and attendants should be retained for this service throughout the war, for they will gradually acquire a certain amount of experience which it would be unwise to throw away. Wagons for sick officers might, by suppressing a few berths, and substituting a few luxuries in the way of furniture, be made a trifle more comfortable. To have as few wagons as possible, no wagon is given for medicines, instruments, etc: one of the surgeons could be detailed to superintend the preparations of the medicines, and, as not a large quantity will be needed, owing to the limited duration of the journey, these may be packed in a suitable chest, for which room may be found in one of the wagons. The draughts and mixtures should be all prepared as much as possible beforehand, and placed in the train ready for use. Cases which have received a special treatment, which it is considered undesirable to alter in transit, should be so ticketed for the information of the medical officers.

The French Society for the help of the sick and wounded showed at the Paris Exhibition of 1878 a model wagon which could be used also for ordinary traffic purposes.* The seats and backs required when this wagon is used for patients able to support the fatigues of the journey in a sitting posture, fold up into the sides of the wagon, and are locked up in time of peace, occupying no space. The beds are packed close to the roof, the end doors are not used, and the roof, ventilators, and skylights are closed by wooden panels securely screwed from the inside. The springs can bear a weight of 10 tons but are flexible enough to reduce the shocks considerably.

Hospital Ships.

Where military operations take place in the vicinity of the sea, or in cases where there are navigable rivers close at hand, ships can be used for the transport of the sick and wounded, for their treatment in floating hospitals, and ultimately for their removal to their own country. This is a style of conveyance which causes them less suffering than any other. Floating hospitals at the base are very necessary: empty troop-ships or transports can be fitted out and used as auxiliary or convalescent hospitals. From the floating hospital evacuations of sick should be carried out, all men not likely to be of any further use in the campaign being thus disposed of.

We made use of ships to convey our sick to the hospital at Scutari during the Crimean campaign, but the arrangements were not of the very best; in fact, Europe was then only awakening from a long period

* See *Le Matériel de Secours de la Société à l'Exposition de 1878.*

of peace, and the study of the assistance to be rendered to the sick and wounded, as well as the investigation of the best *matériel*, and best method for their removal, which has lately occupied the attention of many eminent professional men, had not then begun. There is no gainsaying the fact that the feeling of sympathy raised in the public mind in favour of the sick and wounded in war is originally due to the press. The war correspondents have done a great deal in exposing the inadequacy of the means at the disposal of modern armies for alleviating the sufferings of the soldier struck either by sickness or wounds; and though there are certain undeniable drawbacks connected with special correspondents in the course of warlike operations, still the soldier on this important score, if on no other, owes them a great debt of gratitude. As their appearance principally dates from the Crimean time, it may also be said that the efforts of the public in favour of the sufferers in war originated in that struggle. Thus, in alluding here to that period, it will not be considered out of place to pay a just tribute to the services special correspondents have rendered to humanity. The war of 1859, in Italy and the secession war in America, following closely on the Convention of Geneva, gave a great impulse to this question. The Americans were the first to establish regular sick trains with proper conveyances on their railways, and they also employed large steamers fitted out as hospitals on their rivers during the war.

When it became imperative for us, in 1867, to despatch a force to punish King Theodore, and release the captives he had in his hands, three fine steamers were fitted out as hospital ships, and were despatched to Annesley Bay for the sick and wounded of the Abyssinian Expeditionary Force. The "Golden Fleece," "Mauritius," and "Queen of the South," were the three ships, and were reported to be capable of accommodating 420 sick in cots, and 184 in hammocks. There was plenty of room to accommodate the first number comfortably. Two other ships were fitted out for the same purpose in Bombay, and sent to the base at Annesley Bay. These ships proved invaluable; Annesley Bay being simply a bay, and the base being established on the open shore, there were no suitable buildings which could have been converted into hospitals, and any temporary erections, such as huts, sheds, etc., could not but have proved very hot and unsuitable.

Dr. Roch, who had medical charge of the "Golden Fleece" submitted at the end of the expedition the following outline of what he considered a model hospital ship.* This outline was drawn up from observations made at the time of what appeared the principal points that needed attention, and, as it is desirable to profit from former experience, it will not be amiss to record them here for future guidance:—

"The class of vessel best adapted for this (hospital) purpose, would appear to be an iron ship, not less than 10 feet between decks (*i.e.*, between the upper and main deck), lined with wood on the outside down to the water-mark, with a non-conductor of felt between the wood and iron, pierced along the sides with large square ports, 3 feet by 3 feet. Two large central ports on each side, flush with the deck, and sufficiently large (8 feet by 8 feet), to admit readily a wounded man on a hospital stretcher or dhooly, when raised out of a sick boat by a tackle. These ports should be furnished with gangways and ladders for the accommodation of the sick.

"The lesser ports should be furnished with slides—one for glass, the other for Venetian blinds—and should have side ventilators to catch the breeze from the bow.

"An iron ship is chosen as less likely to absorb and retain poisonous miasma or contagion; and lining the outside with wood, etc., will

* Vol. II, "Record of Expedition to Abyssinia," page 321.

overcome the objection of the iron being the greater conductor of heat and cold.

“Upper deck.”—The upper deck should be furnished with nettings instead of bulwarks arising flush from the deck; or should bulwarks be deemed necessary for safety at sea, they should be so constructed as to be capable of being removed when at anchor, and nettings substituted in their stead, otherwise a great source of ventilation will be lost, and short ventilators rendered comparatively useless.

“The saloons and latrines of the officers constituting the staff of the hospital, together with those of the officers of the ship, should be on deck if possible; or in the event of space not admitting this arrangement, I would recommend a portion of the bow or main deck to be fitted for this purpose, where I would also have any cabins for sick officers placed, viz., next in front of the sick soldiers, the object of this distribution being to obviate the danger of contagious miasma passing from the sick to the healthy staff of the hospital.

“Of the houses on this deck, the cooking galley for the sick should be the most forward, as from the number of diets to be cooked, and consequent fires necessary, the temperature rises to an extreme degree. (On board the ‘Golden Fleece,’ during the Abyssinian Expedition, in the cooking galley it varied from 130° to 150°.)

“The cooking galley for the saloon, bake-houses for the sick and saloon, cooking galleys for the sailors of ship, and washhouse for sick, should follow in rotation backwards towards the funnel,—the object being to place those deck-houses or galleys where the greatest heat is generated in the relatively coolest position.

“Wash-hand basins and waterclosets for convalescents and Army Hospital Corps should be placed one on each side of the deck. The latrines to overhang the water with a direct drop. Those on the leeward side to be used only.

“The advantages of overhanging latrines, contrasted with those constructed inboard, both for use at sea and in harbour, has been sufficiently proved by the experiments in the ‘Golden Fleece.’

“Main deck.”—For the hospital, one main deck running fore and aft, without bulkheads, ventilated and lighted from above by skylights, one on each side, extending the entire length of the deck, large enough to admit windsails when necessary, and fitted with sliding windows at the sides, same as for ports; the top to be solid, capable of being raised to catch the breeze, or lowered in bad weather, and made available for seats when the patients can come on deck.

“The ‘quarter galleries’ to be used as latrines, so fitted as to overhang the water directly, and at such distance as to dispense with the necessity of pipes. Other latrines might be placed at the bows, of the ordinary description, supplied with water from tanks on deck. Any further waterclosets or urinals that might be deemed necessary should be placed as nearly as possible opposite the engines on each side, and an auxiliary engine should be fitted to keep them constantly flushed with water, and which might also be made available for turning a pair of ‘thermanidotes,’ one at each side of this deck, or for keeping ‘punkas’ in motion, should they be considered necessary. The baths for patients should also be placed in this position, and should contain a constant supply, from the engine-room, of cold and hot water. This last is essential, as the coppers in cooking galley being almost always in use for the preparation of diets, there is often a difficulty in obtaining this agent when required.

“Lower, fore, and after-decks.”—A portion of this deck (the lower after-part for instance) should be allotted as a hospital for the sailors of the ship, another part should be fitted for the Army Hospital Corps,

and a portion for the sleeping berths of the petty officers and sailors of the ship.

"Orlop deck.—Portions of this space should be allotted to the various hospital and Purveyor's stores, ship stores, etc.

"From this deck it is in my opinion highly essential that tube ventilators should be fitted as outlets for the foul air and gases which must arise from the stores, and for the escape of the heated air arising from the recently filled water-tanks.

"The water-tanks should be close to the bottom of the ship, and fresh-water condensers fitted of sufficient power to supply water at as low a temperature as possible.

"The tanks to be cased in wood, and fitted with air-tight manhole doors to prevent the escape of moisture, and air-pipes to open outside the ships, to let heated air escape as tanks become filled.

"Bilge.—There should be a free communication between all parts of the ship's bilge, and it should be so arranged that it could be flushed from either bow or stem, and pumped out as dry as possible. There should also be fitted along the ship's side a concave sheef or segment of a funnel, to prevent the bilge running up ship's side as she rolls, by throwing it back upon itself. This should extend the entire length of the bilge-well, and as far further as necessary.

"Awnings.—Great care should be devoted to the proper adjustment of awnings for hospital service. They should be double, having separate ridge vosses; and when set they should be separated not less than 3 feet from the bulwark or outside edge, and not less than 4 feet at the centre, in order to permit a free current of air between them, either from the side, should the ship be swung across the wind, or fore and aft, should the vessel be lying head to the wind.

"As each upper and lower awning, from their great size, becomes unwieldy and difficult to take in, in the event of a sudden violent squall, not an uncommon occurrence in the tropics, I would suggest that each should be composed of separately conveniently sized portions, fastened to sliding rings on their respective ridge-ropes, and so arranged at the centre with blocks, &c., as to be capable of being drawn together or "brailed in" when occasion required.

"All windsails and outlet shafts should open above the upper awning when practicable; and one of the Dantan fire-engines should be so fitted with a hose and rose as to be capable of damping occasionally the awnings, by which the temperature beneath would be reduced, and the dry parching nature of the atmosphere, often experienced in the tropics, to some extent mitigated.

"Ventilators.—In addition to the means already noted in speaking of the hospital deck, the following may be adopted with advantage as additional means of ventilation.

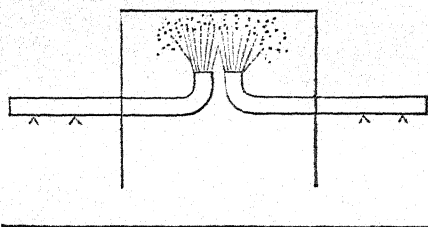
"1. Dr. Edmond's ingenious and now generally adopted system, comprising the advantages of the heated coil and blast; but in constructing or surveying this apparatus, care should be taken that the steam supply-pipe leading from the boiler should be of sufficient area to supply with full effect its branches, viz., the blast and heated coil, it having been found, in the case of the 'Golden Fleece,' that a greater volume of air was eliminated when using the blast alone than when its strength was divided between the blast and coil, in consequence of the main steam-pipe not having been sufficiently large.

"2. A modification of Dr. Edmond's system might in some cases be adopted with advantage, dispensing with the heated coil by conveying a metal tube or shaft from either end of the hospital deck (main deck) along the ceiling to the funnel, one from the stem, the other from the bow, having openings at regulated distances fitted with two slides, one

of perforated zinc, the other a plain piece simply to close the aperture altogether: thus all may be used open simply as free outlets, or the current might be modified by the use of the perforated zinc slides, or some might be closed altogether occasionally, which would have the effect of concentrating the draught at the remaining open ones, should such be deemed advisable.

"As all hospital ships will require the condensing engine to be constantly at work, both for the supply of water and the other purposes already noted, there will always be a sufficient blast in the funnel to keep the above simple arrangement (a sketch of which is appended) in operation.

FIG. 18.



"3. Tube ventilators, except as outlets, have in my experience not been so effective as windsails, perhaps owing to the greater height to which the latter can be raised, catching the upper current of air, as well as to the greater spread of their wings. The disadvantages arising from tubes passing into and through the hospital decks are a considerable loss of cubic and superficial space, leakage consequent on the decks being cut for their admission, &c.

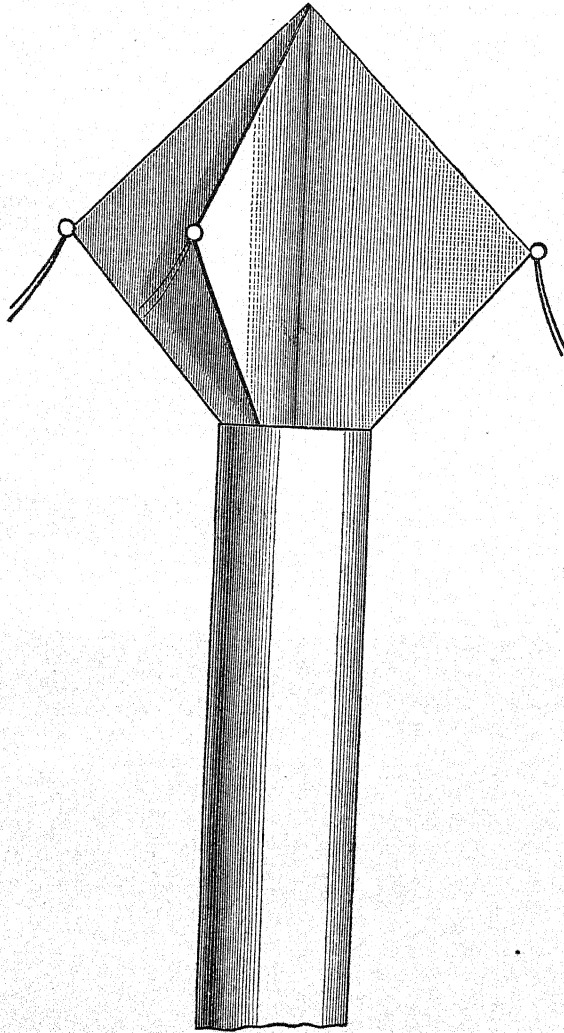
"Great inconvenience was felt from this cause in the 'Golden Fleece,' the water penetrating from the upper deck in spite of all attempted remedies, producing in bad weather a most unsanitary condition of the hospital, and destroying the bedding.

"The advantages of tube ventilators become therefore, problematical, and the only portion of the ship in which their use is without doubt, beneficial, is the orlop deck, as indicated in my remarks under the head of 'Orlop Deck.' Tube outlet shafts should, if possible, open either above or between the double awnings.

"The short metal deck ventilators (Government pattern), as used in sick officers cabins, 'Golden Fleece,' answer pretty well with nettings instead of solid bulwarks; but they would be much improved by the addition of a lip round the top, curving outwards and downwards (as recommended for the bilge well) to prevent the water splashing over while washing decks, and by increasing the length of the projecting cowl to prevent rain, &c., from entering.

"A near approach to a mushroom shape would, in my opinion be an improvement. Windsails might with advantage be made to fit inlet tubular shafts, and to avoid the inconvenience of constantly resetting them. Self-adjusting windsails with four wings (a sketch of which is annexed) might be used for this purpose.

FIG. 19.



"Whitewash v. Paint.—The advantages of whitewash over paint, as a non-conductor of heat, are now pretty generally acknowledged; and experiments have shown a decrease in temperature, in favour of this agent in tropical climates, of 3° below white paint, of 7° below buff, and 15° below black.

"All hospital ships for tropical service should therefore be whitewashed on the outside; and I strongly advocate its adoption for the inside of the hospital decks, as more cheerful, cheaper, more readily renewed, and a more sanitary agent than paint.

"It was adopted with the happiest results in the 'Golden Fleece,' both inside and outside, during the Abyssinian Expedition, and greatly

improved the light in, and cheerful aspect of, both the officers' saloon and hospital decks.

"For internal use, it was simply prepared by mixing the lime with thickish rice-water, no size or other agent being used.

"Paint must be washed clean and free from grease before this wash is applied over it.

"*Matting round Ship.*—Bamboo matting was tried in the 'Golden Fleece,' projected on bamboos from the ship's side, as a sort of shade or verandah, but the result was not satisfactory. It was constantly getting smashed by sailing boats coming alongside, and in high winds it was liable to be blown away altogether. A better mode of application, particularly in the case of wooden ships painted black, would be to have it tacked along the sides, leaving or cutting spaces for the ports, when it might be occasionally wetted with the hose, and thus act beneficially in cooling the ship in very hot weather."

In the operations on the Gold Coast of 1873-74, and capture of Coomassie, the "Victor Emmanuel" hospital ship was carefully fitted out at home and sent to Cape Coast Castle. It took about two and a half months to fit this ship and to get her ready for sea. The "Victor Emmanuel" was a wooden ship with a height of main deck of nearly 7 feet, from deck to deck. On this deck accommodation was provided for 140 patients, and in the lower, or gun deck, for 60 convalescents. The medical staff consisted of an army surgeon-major with six or seven medical officers, and the following non-commissioned officers and men:—

NON-COMMISSIONED Staff and Rank and File, Army Hospital Corps, required for the working of the "Victor Emmanuel" Hospital Ship.

	Staff Sergeants.	Sergeants.	Corporals.	2nd Corporals.	Privates.	Total.
Sergeant-Major (or acting rank) ..	1	..	..	..	..	1
Compounders	2	..	..	..	2
Stewards	1	..	..	..	1
Assistant Wardmasters	2	..	..	2
Clerk, Principal Medical Officer	1	..	..	..	1
„ Captain of orderlies	1	1	..	..	2
Park stores	1	..	..	..	1
„ Storeman	1	1
Steward's room	2	2
Barber	1	1
Carpenter and medical storeman	1	1
Tailor	1	1
To work laundry	1	..	6	7
Orderlies, hospital deck	14	14
„ convalescents	3	3
„ sick officers	4	4
To replace casualties	1	2	2	6	11
Total	1	7	6	2	39	55

A special hatchway was cut in the deck, immediately abaft the mainmast, for the special purpose of lowering the sick or wounded down to the hospital deck. Great care was taken to obtain the best ventilation for the ship; there were 66 ports, $3\frac{1}{2}$ feet high by 3 feet wide, and 5 scuttles, each 8 inches in diameter. Two planks were

besides removed from each side of the upper deck, fore and aft, to the extent of about 79 feet, to act as ventilators to the main or hospital deck. This ventilator was divided into four parts, properly covered by long wooden hoods, which could be raised or depressed in order to regulate the ventilation as required. The cots were numbered on the beam above, and were arranged in three rows fore and aft on each side of the deck with $2\frac{1}{2}$ feet of gangway space between each row. A convenient hand-rope was placed over each and all the unoccupied ones could be removed at will and stowed away. The iron cots in the main deck were fitted to rock and lock, and besides these were a few specially constructed for certain surgical and medical cases, which experience had shown to be much needed. Mosquito curtains, rendered fire proof by immersion in tung state of soda, were provided for each cot, and light canvas screens to isolate any single patient or set of patients from the rest. These screens were hooked up when not required, and the cots and other articles, when not in use, were removed so as not to impede a free circulation of air.

Double awnings were spread over the ship, and the hospital deck was painted white, but, with the glare of the tropics, a toning down was found by experience to be necessary. The orlop deck was used as an issue room, and as a store for medical comforts, wine for hospital and saloon, troop bedding, &c. The berths for the crew were in the gun deck, from mainmast forward. By a simple contrivance the foul linen was hoisted in closed galvanized iron boxes from the hospital deck below, and sent at once into the washing chamber and, if necessary, plunged at once into hot water. Massey's, Dowton's, and other pumps were provided in great numbers and variety for pumping bilge, washing decks, flushing closets, and extinguishing fires.

The "Victor Emmanuel" being intended for service in a warm climate where ice is a great luxury, and where nothing is so acceptable to a sick person as a cool beverage, was provided with a large ice making machine capable of manufacturing nearly half a ton of ice a day; the daily manufacture averaged 480 lbs., produced at the moderate cost of 2d. per pound. Hospital ships may have to remove sick from warm to cold latitudes, and have to be prepared in such a way that, whilst they ensure a plentiful supply of fresh air in the first, they also provide means to protect the sick from the severity of the colder climate. This can best be obtained by the use of screens, stoves, &c., and for this purpose the main or hospital deck of the "Victor Emanuel" was provided with six American Deane and Co.'s, 16-inch stoves.

For the lighting of the hospital deck, 26 Palmer's candle lamps were used, which were unshipped during the day, and hung at night in such a way that the glare should not cause any discomfort to the eyes of the patients. Three and a half tons of fuel were consumed per day whilst at anchor, for condensing and all other purposes.

The "Victor Emanuel" anchored at Cape Coast Castle on the 1st January, 1874, and started on her return to England on the 26th February, 1874, reaching Spithead on the 10th April. The invalids admitted during her stay on the coast numbered 565, of whom three died on board before her leaving for England. Of the above number 125 were transferred to other ships or rejoined their own corps, 104 were discharged fit for duty, and 165 were invalided home. The remaining 167 cases (of whom 4 were officers) were conveyed home when the ship quitted the Gold Coast, and of these 3 officers and 7 men died on the passage, and 31 were admitted for treatment on arrival in England.

In all ships great attention should be paid to the hold and bilges,

as the health of the crew depends to a great extent on the constant means taken to remove any filth and water from decayed parts of the ship, which accumulates and stagnates the hold. But in a hospital ship, where the best hygienic arrangements must be secured for the patients, the hold of the ship has to be more than ever carefully watched.

Hospital ships are not equal to hospitals on shore, as proper ventilation and cleanliness are more difficult to obtain. Where several ships are provided, one should be detailed for wounded men, one for fevers, one for other cases. Infectious cases like gangrene, pyæmia, erysipelas, &c., should be treated on deck. Frequent fumigation and lime washing are necessary. Directly a batch of sick have been landed, a thorough cleansing of the whole ship should be done, including scraping, washing, fumigating, &c.; until this is thoroughly carried out, no fresh patients should be taken on board. A hospital ship should be dry, clean, and carefully ventilated. When the ship has two decks, all the worst cases, should be placed in the upper deck.

The fittings, which should be few and simple, should be of iron, for iron is more easily and thoroughly cleansed than wood. Fixed berths are not so good as swinging cots. These can be suspended from the roof or supported by iron standards.

Ambulance Wagons, Country Carts, and Pack Animals, for Sick Transport.

We have placed railways and hospital ships at the head of all means for the removal of the sick and wounded of an army, as these improved means, particularly those of water carriage, permit of the removal of a very large number of patients to a considerable distance with the least discomfort to them in transit. But not only have all countries not improved alike in the construction of railways, but, even in those that are well provided with them, as armies move in every direction, it is possible for a battle to be fought several miles from one, even when an army is mainly operating along a railway line. Again, and this will generally be the case, there will be a break of some miles between the serviceable end of a railway, and the front of an advancing army, caused by the destruction of the railway line by the retreating force. With a very numerous army, also, one, or both flanks may be operating at a considerable distance from a railway line, and perhaps with not the best roads leading to it. This shows that in all cases we must be prepared with suitable *matériel* to move the wounded over longer or shorter distances, and for this purpose regular armies generally use ambulance carts, mule litters, country carts, and such other means which can be extemporized on the spot. Dr. Gurlt says:—"In great battles, there never will be a sufficiency of means of transport, whatever provisions may be made in this respect, the farmers carts can never be dispensed with." The ambulance carts, like all other *matériel* for the care of the sick and wounded, have of late years been much improved, they have been made lighter, and with various contrivances to take in the field stretcher, thus carrying out the principle now considered so necessary of moving the sufferer as little as possible, once he has been placed on a stretcher on the field of battle. Ambulance carts carry four or six patients lying down, but some are constructed to carry either four or six patients lying down, or twelve lighter cases sitting, or with accommodation for lying down patients on one side, and for sitting ones on the other. It would be on no real use to enter into a description of the construction of ambulance wagons, for each regular army will be found provided with a different

description, constructed on some special plan, which meets the views of its medical staff as to what they consider the special requirements principally to be attended to in the transport of badly injured soldiers.*

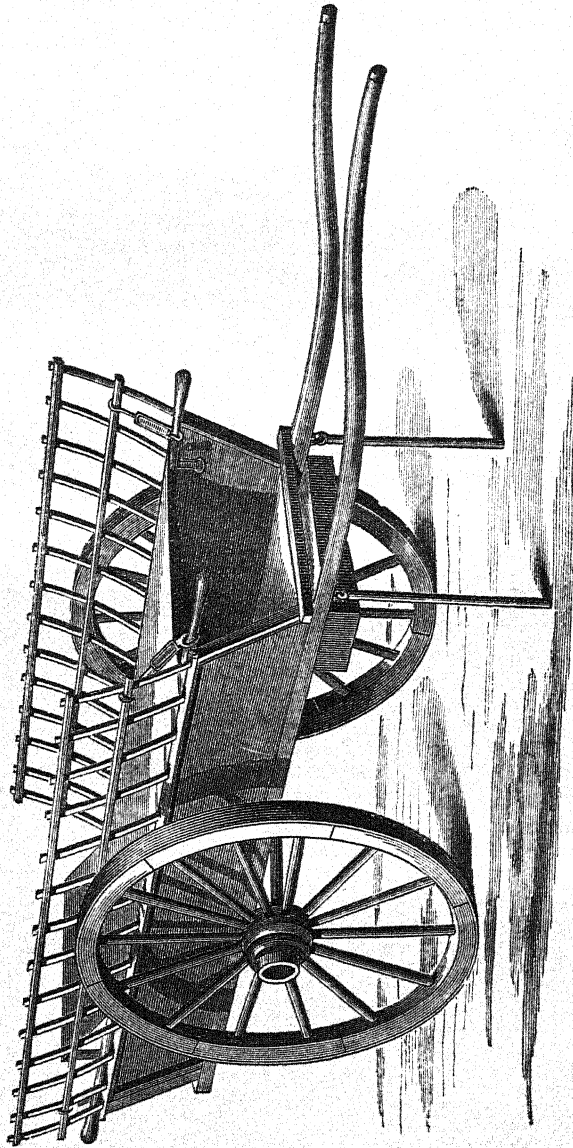
In debarkations likely to be opposed by the enemy medical officers land only with stretchers; no ambulance wagons are taken on shore until the landing has been made good, as these might be captured on the troops having to regain their ships. Ambulance wagons require good roads, which are not to be found near every battle-field, it is, therefore, for this reason that beasts of burden have been called to assist in removing the sufferers in litters or cacolets, as these animals can move and follow the combatants over every description of ground. R. Delafield (*Report on the Art of War in Europe*), speaking of pack mules carrying litters or chairs remarks:—"The requisites for an ambulance should be such as to adapt it to the battle-field, among the dead, wounded, and dying; in ploughed fields, on hill-tops, mountain slopes, in siege batteries and trenches, and a variety of places inaccessible to wheel carriages, of which woods, thick brush, and rocky ground are frequently the localities most obstinately defended, and where most soldiers are left for the care of the surgeons. These difficulties were felt in a great degree by all the armies allied against Russia in the siege of Sebastopol, and the consequence was that the English, French, and Sardinian armies adopted finally, in part or altogether, pack mules, carrying litters or chairs."

With whatever establishments of ambulance wagons, mule litters, &c., armies may take the field, it has always been found after a serious engagement that these have been insufficient to remove the wounded even from the battle-field to the field hospitals and lazarets, so that the carriages of the country had to be pressed in large numbers for this service. Carriages of every description have been used for this purpose, but what heart-rending stories could be told of the sufferings of the poor wounded soldiers jolted along for miles in springless carts, over rough and uneven roads, with no covering to protect them from the scorching rays of the sun, from a biting wind, merciless rain, or even snow, with no regular attendants to satisfy their thirst, quench a choking dust, or place them in a more comfortable and easy position. Generally speaking, all the preparations that can be made are to spread a certain quantity of straw or hay on the bottom of the carts, on which the sufferer is laid, but this has little effect in deadening the jolts and shocks on the way, and greater comfort must be obtained for the patients by preparing some better means whereby to transform these primitive means into more suitable sick conveyances, and remedying some of the defects of stiff, or utter want of springs.

The French Society for the Help of the Sick and Wounded showed, at the Paris Exhibition of 1878, a very simple means for converting common country carts into better means for the transport of the sick. The contrivance simply consisted in providing each field hospital with a certain number of spiral springs, *ressort à boudin* (Fig. 20) furnished with large hooks at each extremity, by which means these could be fitted to most of the conveyances procurable. Four springs are required for each stretcher, the top hooks being attached to the side of the cart, and the lower ones to the handles of the stretcher to which the springs impart great elasticity (Fig. 21). These springs are

* The Americans used a serviceable ambulance drawn by two horses, accommodating four stretchers. The driving box was a complete canteen with cooking articles, plates, forks, etc.; a supply of essence of beef, biscuits, sugar, and coffee were kept in each canteen; two small casks contained fresh water, which was changed as often as practicable. Under the foot-board was a box for the driver's property. Each ambulance wagon carried also six days' forage for the horses.

FIG. 21.



Country Cart bearing Stretcher suspended on Spiral Springs. French Model Spiral Springs.

FIG. 20.



cheap, and occupy very little room, and, being applicable to every description of vehicle, will permit of all the carriages found in towns, villages, farms, &c., being rapidly converted into tolerably good means for removing the wounded, lessening the chances of their wounds being aggravated by the long continued jolting. Where the carriages are narrow, there will be only room for one stretcher, but where they are broad enough, two stretchers can be placed side by side by securing two cross pieces of wood, one in front and one behind, to receive the inward hooks of the springs. If some kind of awning, matting, or grass thatch can be improvised as a protection from sun and rain, so much the better for the sufferers.

We will now consider what means we have for removing the sick and wounded in many of the difficult countries in which we are often called to carry on hostilities. Here the evacuation of the sick will be principally on the base, to be treated there either in hospitals or in hospital ships, or to be sent back from whence they came originally, or else to their own country. The number of sick and wounded in these expeditions will not be large enough to affect the health of the troops, for the force employed, generally, does not amount to a very large number, but the country, being intricate and unhealthy, demands a clearance of all encumbrances and the removal of the sick and wounded as soon as possible from the influence of its injurious climate.

In most of these countries there are no roads to speak of, and the country is mainly, if not entirely, traversed by tracks. Ambulance wagons or spring carts it is quite evident would be of no use in countries like these; we must therefore deny ourselves these improved means of transport and fall back on pack animals and human labour. In waging war in civilized countries, a defeated commander can leave his wounded on the battle-field without much compunction, for he can count on the humanity of the victors extending the care bestowed on their own wounded to those of their defeated foes; in fighting in wild countries against uncivilized people the wounded must be removed at any price from the field, for, acting otherwise, the confidence of the soldiers would be forfeited; the enemy have no means to look after any wounded who may fall in their hands, and in most cases they would quickly debarass themselves of this burden by massacring and mutilating all those found on the field. For this last reason, the sick convoys must be escorted, and the escorts must be fully adequate to protect the convoys. Long strings of pack animals and dhoolies cover a great extent of road and demand large escorts.

Often in a scouting party the ingenuity of the officer in command may be taxed to the utmost to provide means for transporting his wounded a long way back to camp or to the field hospitals, where either the character of a country has precluded the means of transport following the troops, or the troops have been compelled to march in the lightest order to follow up a fleet enemy. A certain familiarity with the principal ways of transporting disabled men will come to his aid in the hour of need.

Looking, in the first place, at the animals, we find that the horse, the mule, the camel, and the elephant can be made use of as sick transport. Everyone acquainted with the life of Napoleon will recollect how General Bonaparte, after raising the siege of St. Jean d'Acre gave up his own horse and those of his staff officers to convey the sick, and prevent their falling into the enemy's hands. But the horse in general is reserved for other more important work, and is not used, but as an exception, to remove the sick of an army in any other way but harnessed to ambulance wagons or carts. The Arab plan for con-

veying sick and wounded men on horses and mules should be known to all officers. A sack full of straw, grass, or leaves, is attached to each side of the pack-saddle in such a way as to form with the upper part of it an horizontal plane. A pallet of hay or straw, or a mattress of some soft stuff is placed on this, and the patient is laid on it across the animal and conveyed in this manner from the field. In the wars the French army carried out in Algeria originated the use of mules with cacolets and litters for the transport each of two patients, and this description of sick transport has lately been introduced in our army organization for mountain service. There is no doubt that in certain countries this description of sick transport can be very useful, but, notwithstanding all the care with which the *matériel* is manufactured, and all the improvements which have been introduced from time to time, the patient does not find that even and smooth travelling which his enfeebled state so much needs; indeed, for some description of wounds, this system of conveyance is very inappropriate, and tends to aggravate the sufferings of the wounded. Some difficulty is also experienced in placing wounded men in the litters, and likewise in taking them out. The strength of few mules is equal to the heavy weight they would have to carry, for we find the weight of the pack-saddle, bridle, litter, and pailasse is given at 167 lbs.; and, even if reduced to 100 lbs., the weight of the equipment with that of two men taken at ten stone each, would amount to 330 lbs., and this is a very severe load for a mule at any time, but particularly when travelling over a rough country. For short distances, or for only a portion of a march, this description of sick transport may be of use, but we doubt if it can be ever made available for a continuous movement between the front and the base for serious cases.

Mules are very suitable for sick transport as pack animals, only when especially trained: they are preferable to horses, being smaller, more surefooted, and having a shorter step; they are also less restive than horses under the pressure of heavy weights. For hospital service, they should be specially selected, animals of sufficient docility and strength only being used.

Camels have been employed to transport sick in kajawahs in India and in a specially constructed box in Syria during Bonaparte's campaign in that country. In India they are more used to carry natives than Europeans, but, except in cases where there is no better carriage to be obtained, these animals cannot be recommended for sick transport on account of the rocking motion they have when progressing, caused by their raising alternately both legs of a side together. Kajawahs for sick transport had to be resorted to again in the Candahar column during the late Afghan War, as the dhoolie-bearers fell sick, and many being found too old for work, had to be sent back to their country. Elephants can be used to carry slight cases where lying down is not needed, and can accommodate six men easily. Where no proper chairs are available, six men sitting on the pad, two on each side, one in front and one behind can travel comfortably enough. These animals however, are too useful to employ in carrying sick and convalescent soldiers, and are not generally used for that purpose.

The officers of the United States army in the wars with the American Indians, when moving on ground unsuited for wheel carriages, have used two-horse or mule litters, the animals being harnessed one in front, and the other behind, in the same way as the bearers in the common field stretcher. This style of sick transport entails a great waste of power, as two animals and several attendants are required for each patient, but, independent of this, it is also open to other grave objections. If one animal moves more rapidly than the other,

damage to the litter or harness will ensue; the litter cuts off sight of the ground from the hindmost animal, and renders him particularly liable to stumble; if one of the animals stumbles and falls, either the other one will also come down, or the conveyance will be broken. If the two animals keep step, the litter vibrates to such an extent as to almost throw the patient out; if, on the other hand, they break step, a compound joggling motion ensues, very discomforting to the patient. The length of the animals and litter are serious drawbacks in tracks where sharp curves and turnings are frequent. This contrivance is therefore inapplicable to very rough country, and unsuited for narrow winding mountain trails and densely wooded country. If used at all, animals well trained and of uniform gait are required.

The travois (Fig. 22) has likewise been used by the United States troops for sick transport purposes. This contrivance is extensively used by all tribes of Indians in North America for carrying all sorts of baggage with no impediment to rapid marching, and, in case of battle, coming in handy to remove the wounded from the field. It is a litter in which the ends of the poles rest on the ground on one side, and act as runners, the animal being hitched between the other ends in front: it is thus drawn along the ground, the rear being lifted and carried whenever obstructions occur. A plain country is the most favourable for its use; over deep snow or ice the smooth gliding of the travois may also be serviceable. It is open to objections, still it may be a very useful means of sick transport in a level or slightly undulating country for wounds other than fractures. For wounds of the trunk, and fracture of the thigh, this contrivance is less objectionable than when employed for wounds of the head, and fractures below the knee, in which cases the jarring and bumping on the ground cannot but cause great distress. It is well spoken of by some American officers, and, where there is nothing better to be found, may come in useful.

Sick Transport by Carriers.

Sick conveyance in dhoolies, hammocks, swinging cots, dhandies, muncheels, and ton-jons, fortunately can extend to most of the countries where an improved system of transport, or wheeled carriage cannot be used. Of all these the dhoolie is undoubtedly the best, for it affords protection from the sun, rain, and dust, can be laid down anywhere on the ground, allows tents to be dispensed with, and in transit the equilibrium of the dhoolie, and the absence of any swinging motion affords comparative rest to the patient.

In all sick transport effected by means of carriers, the embarrassing point is the number of followers it entails, and the disadvantage of having so many extra men to feed, for each dhoolie, etc., requires six carriers. Where the sick carriage is calculated at 10 per cent. of the fighting force, it will be seen what a large number of followers this alone will entail. Transport done by carriers is very primitive, most countries as they progress are found to substitute animals for men in carrying burdens on their improved roads, and the professional carrier gradually disappears. India has not been an exception to this rule, even as far back as the time of the Indian mutiny, a traveller on landing would have remarked that in the principal presidency towns of Calcutta, Madras, and Bombay, the people in course of business or pleasure used palkies largely as a means of conveyance; but since the introduction of the horse gharee, buggy, and later on of the tramway cars, this old-fashioned style of conveyance has, like our sedan chair, almost entirely disappeared from the presidency towns, and is now seldom met with anywhere. Likewise in those times travelling

from station to station, going to the hills, etc., was performed in palkis or dhoolies, but the introduction of the bullock dak, the wretched horse dak, mail carts, and lastly railways, have here also driven the antique conveyances out of the field. However more comfortable and rapid the new means of locomotion are, still the supersession of the old modes has had a great effect in reducing the number of professional trained carriers; this falling off in their numbers was felt as far back as 1857, when the large army we had in the field in India in the suppression of the Mutiny needed a corresponding large number of sick carriers, and this difficulty has steadily increased since that time. The style of progression, which secured the absence of all swinging and jolting motion, was the result of careful training and practice, which the small demand for the services of trained carriers has considerably impaired.

As one medical officer can well look after 40 sick or wounded, the organization of a division of sick bearers should be based on that assumption, and might be composed as follows:—

Division of Sick-Bearers.

Strength.	Equipment.
1 Commander.	Two ponies,* with saddlery complete.
1 Surgeon.	40 hammocks, cots, dhoolies†, etc.
1 Staff Sergeant.	40 sets shoulder-pads.
4 Superintendents.	24 oil bottles.
8 Mates.	288 suits of clothing.
4 Hospital Orderlies.	288 blankets.
2 Attendants.	288 number-labels.
2 Cooks.	288 clasp knives and lanyards.
2 Batmen.	4 water-bags.
4 Water-Carriers.	1 set scales and weights for rations.
264 Carriers.	12 sets arms and accoutrements for superintendents and mates.
Interpreters as needed.	1 medical field companion.
	3 tents.

Six men are required for each hammock, dhoolie, or swinging cot; a division as above with 240 carriers will provide conveyance for 40 sick or wounded: 10 per cent. spare carriers are added, and these can carry torches at night, for, as in hot climates much of the marching will be done by night, torchmen are indispensable. The carriers generally make their own torches, either out of rags, or of some resinous description of wood; the spare men by day will be useful in carrying food for the remainder, or as extra reliefs. A division as above can be divided into two sub-divisions, and detached if needed; each superintendent would look after 10 dhoolies with two mates under him to look after each five. The Medical Department should arrange for the medical officer and trained hospital orderlies and attendants to be attached to each division. Cooks to prepare what is needed for the sick should not be overlooked.

If no clothing is issued, the carriers should still wear a distinctive head gear, a specially coloured pugaree or turban, or other conspicuous distinctive to show what service they belong to. Each hammock, cot,

* The two ponies are for the Commander and Surgeon.

† Each dhoolie, hammock, etc., should be provided with a water bottle, *chagul* or other article to contain fresh water.

dhoolie, etc., should be numbered in large figures, which should show both the division it appertains to, and its consecutive number in the same; each set of carriers should bear the same figures as the hammock, or dhoolie, they are told off to. To provide against waste of transport, when not required to carry the sick, the bearers should carry provisions. The men should be required to build their own lean to huts for shelter.

The question of food for the large body of dhoolie bearers does not seem to have been fairly examined, for a two-horse ambulance wagon will require for forage and rations for the driver, about 43 lbs. a-day, each wagon carrying four sick, lying down. As the bearers do not receive as a rule the same weight of rations as the soldiers, say about $1\frac{1}{2}$ lb. of food a day, the difference in point of food would be in their favour, as four sick would be carried by 24 men, receiving 36 lbs. of food only. The carriers might, besides, come in useful for other purposes when there are no sick to carry, for example, to collect fire-wood, clear jungle, prepare shelter huts, make roads, etc. The Indian cahars, as a rule, are great fishermen, and, besides making their own nets, generally contrive to catch any fish that may be found in any river or pond close to camp. The dhoolies will not be required until a serious engagement ensues, or the climate begins to tell on the troops, and some use might be made of them in an advance, by making the bearers carry, if nothing else, a stock of supplies for their own consumption. Each dhoolie could carry about 150 lbs. (about the weight of a man) which would supply the carriers with food for over 12 days, at 2 lbs. per head. Even if this amount was carried only for a few marches, it would be always something gained. If hammocks are used they can be rolled up and carried by one man, the rest carrying loads as the common carriers.

The weight of the old army dhoolie was 136 lbs.; this was reduced to 58 lbs. during the China war of 1860, as the carriers in that country were not fit to carry the heavy Indian dhoolie. This, besides, was made for use in India, and never constructed with the idea of being packed on board ship for transport to a foreign country; but, when in the China and Abyssinian war, this necessity arose, it was found that the old dhoolie did not answer all requirements, and demanded some alterations and improvements. Hammocks and swinging cots have been used for sick carriage, particularly on the west coast of Africa; the second was substituted for the first, as it was found that the patient was made uncomfortable by the curved and straitened position of his body, and the swinging motion of the hammock. Hammocks and cots are light, pack easily, and for a hilly country have not the same objections as the dhoolie, being carried further from the ground. Having no legs they have, however, the disadvantage that they cannot be laid on the ground, or made use of in camp, unless some contrivance for resting the pole is improvised. In the Aswantee War, rough tripods (Fig. 23) were extemporised on the march to rest the poles of the swinging cots on, and keep the patients off the hard ground. Dhandies, muncheels, and ton-jons are more suitable than the dhoolie for a hilly country, and weigh much less, but are not constructed to carry patients lying down, but sitting, and have generally no cover to protect the occupant from sun or rain.

From this cursory examination, it results that the old dhoolie still retains its place at the head of the contrivances designed for the transport of sick by carriers, as it has advantages the others have not, but that it requires to be made lighter, and to be constructed so as to pack easily, and take little room on board ship or in railway wagons. Surgeon-Major Isidore Bourke has contrived a dhoolie which

is a great improvement on the old army one, takes easily to pieces, and packs into small compass. A great advantage of his dhoolie is the many uses it can be put to; amongst others, it can be used as a hand stretcher to remove the wounded off the field by two men, the stretcher being equally available afterwards for their conveyance by rail, on board ship, or in ambulance wagons, when these means are at hand; it forms a convenient bed; the slings which support the bed part of the dhoolie, being capable of adjustment, can be shortened, at either end, a great advantage either in going up or down hill, or in crossing rivers. This last point is of great importance, for the old dhoolie comes so near the ground that it is difficult to use it on steep inclines, and great risk of wetting the bed or patient is run in crossing water, unless the pole is carried on the bearer's heads, or they raise the dhoolie bodily on their shoulders.

The Indian bearers are not accustomed to carry by hand; with them all weights are supported on the shoulder. They move at the rate of $2\frac{1}{2}$ miles per hour, including halts, and sometimes even faster, but this depends upon habit and training, as well as the nature of the country.

In the Ashantee war of 1873-74, the Ashantees removed their dead and wounded in wickerwork cradles, or long narrow baskets, each borne on the head by two slaves, one at each extremity. We copied this contrivance, and removed a few wounded Houssas in this way at the end of the war. The carriers were from time to time relieved of their burden by spare men. In many parts of Africa weights are generally carried on the head, thus cots and hammocks in the Ashantee war were carried on the head, a cross piece of wood being fastened to the pole for the carriers to bear the load.

We have examined briefly, the transport generally used for the removal of the sick and wounded, and for their dispersion into smaller groups in rear of the field army, to avoid the danger always incurred by a large conglomeration of sick. These transport means of themselves would be of little avail where accommodation is not prepared for the reception of the patients along the line of communications. The field hospitals must be kept entirely for the purpose they were originally intended for, and should move forward with the troops; hence one of the main cares of the communications staff must be to provide means for freeing these as soon as they become stationary, through an influx of sick, so that they may rapidly rejoin the troops. This can be effected either by moving up reserve hospital establishments, or by removing the patients to suitable establishments already prepared for their reception in rear. In the latter case the *matériel* of the field hospitals can under no circumstances be made available for the clearing of these hospitals; this must be provided from other sources.

A peculiarity of the German system with regard to the medical arrangements in the field deserves to be noticed. In the German army each army corps has three sanitary detachments, one for each of the two Divisions and one for the corps details. There are besides, for each army corps, 12 field lazarets, numbered consecutively from 1 to 12: each of these can provide for 200 patients. In minor engagements, the regimental medical officers establish a bandaging station, to which the sick bearers bring the wounded men, the sanitary detachments only coming into use in more serious actions.

Now, though both sanitary detachments and field lazarets are for the assistance of the sick and wounded, there is a marked difference in the services rendered by each. The first move with the troops, and

are for service in the close neighbourhood of the battle-field; they collect the wounded, apply the primary dressings, and attend to the immediate wants of the injured; but, avoiding the performance of any serious operations, they transfer them either by regular or extraordinary means to the field lazarets, for having to follow their Divisions, they must debarass themselves of the sick and wounded as readily as possible. The lazarets, on the other hand, become stationary the moment their services are needed. Usually one march in rear of the field army, when an engagement takes place, they establish themselves in the most convenient locality close to the battle-field, and occupy either a town or some villages; here they receive the wounded from the sanitary detachments for treatment, and their means being larger, operations can be performed with more ease and comfort than would be possible for the sanitary detachments to undertake. Afterwards, in accord with the *etappen* service, they clear the hospital of the wounded and rejoin their respective army corps by a few rapid marches. Where the needs are not very great, only a portion of the field lazarets become stationary, the rest following the army.

It is obvious that this division of labour possesses several important advantages. The stationary lazarets can perform their work with ease, without troubling themselves about hurrying forward; the army corps are never without the means for promptly relieving the wounded, having the sanitary detachments always at hand, and the field lazarets, always being in the rear, do not encumber the movements of their respective army corps. Another point that also deserves to be noticed is that the *Krankenträger*, or sick carriers, of the German army are not like the sick bearers now sanctioned in our medical organization, untrained men only engaged when the army is placed on a war footing,* but they have all, before going to the field, been taught the most simple surgical operations, the first care to be given to the wounded, how to form stretchers from any materials at hand, the application of the necessary field dressings, the preparation of wagons for the reception of the wounded, and so on. They have received, in short, a certain theoretical instruction in surgery and medicine, and amongst them are to be found students from hospitals and universities.

In a fight, a disabled man is either carried to the rear by several of his comrades, which weakens the fighting line, or he is left to die uncared for; to prevent the first and second contingencies, a body of sick bearers has been organised to remove the wounded from the battle-field. The employment of bandsmen to remove the wounded is open to serious objections, for bandsmen are just as necessary as any other part of the army, to cheer up the men when fatigued on the march, to increase their ardour and enthusiasm by playing national airs, etc.: if, therefore, bandsmen were employed under fire, they would soon cease to answer the purpose for which they are maintained. Sick bearers were first proposed by Baron Percy, one of the medical officers of the revolutionary and Napoleonic wars; the employment of a body of sick bearers in the German army was introduced as far back as 1813, when an Imperial decree sanctioned its formation. According to the present organisation there are 447 sick bearers for each German army corps.

Long practice is required to understand how to lift up a wounded man, how to place him on a stretcher, and how to carry him. To lift

* The privates are added to the bearer companies on taking the field (*vide* tables of 1st December, 1877). The 95 bearers for each company are shown under the head of reserve; this might lead to the belief that they have received or receive some yearly training in their duties.

him up does not require so much strength as skill, and this can be only obtained through training. The even pace of the carriers, in which the Indian dhoolie bearers excel all others, is the result of long training; the uneven motion of inexperienced bearers can only aggravate the sufferings of the wounded. The wounded must be quickly and carefully moved, but to do so skilled bearers and not unpractised hands are needed. To derive all possible advantages, sick bearers must be regularly trained in their work; the men should be furnished with means to effect a preliminary dressing, with tourniquets to arrest a severe hæmorrhage, a pair of scissors to cut clothes open, and a sharp knife to cut open the boots, etc., of a sufferer. They should be taught how to use part of the men's clothes and equipment for a preliminary dressing; how to abstain from giving any drink to men wounded in the head or through the lungs, for fear of bringing on hæmorrhage; how to dispose of the wounded on arrival at the temporary hospitals, etc. The bearers should remain close to the medical officer who is to direct them, and the cases first prepared by the medical officers for removal should be marked by some conventional distinguishing mark that will attract the attention of the bearers.

However different the carriages used for the removal of the sick and wounded may be in construction, the adoption of one uniform kind of stretcher seems particularly desirable. This should be adapted for all carriages alike, for it is of importance as soon as the stretcher bearers reach the first conveyance to place the wounded man in, and not to have to take him to the rear amongst a confused mass of carriages to seek for a particular one adapted to take in their stretcher. The foremost carriage must be loaded and packed off first, the remainder moving up and filling in their turn. A uniform stretcher would come alike useful in ambulance wagons, sick railway trains, hospital ships, etc.

The provision of wooden trestles (Fig. 24) will enable the stretchers to be utilized as temporary beds, when none are available.

It should not be forgotten that the prompt transfer of the wounded after they have been injured to a field hospital or other place where their wounds can receive attention, has a great effect in saving life and limb, and that surgical aid will be ever so much more effective the less time elapses between a patient being injured and his injuries being attended to. Field hospitals should therefore be brought up as close as prudence will permit to the scene of engagement, to render quick assistance to the wounded. As this will shorten the length the sick bearers will have to carry their burden, each pair will be able to remove more unfortunates from the field in a given time.

The want of hospital establishments and means for removing and attending to the wounded will cause serious delays to an army after an engagement,* as a case in point take the British Army after landing in the Crimea; there the sick carriage consisted of 10 stretchers per regiment, there were no vehicles for the transport of the sick and wounded, for the British Army landed without a single wagon. It took two days for the wounded after the battle of the Alma to be dressed and sent on board ship, though luckily the ships lay close by. The army had thus to halt for two days, and would have had to halt longer, had not the French come to its assistance with the loan of their sick carriage. In the battles in and around Corinth during the American War, five days after the battle soldiers were found whose wounds had not been dressed.

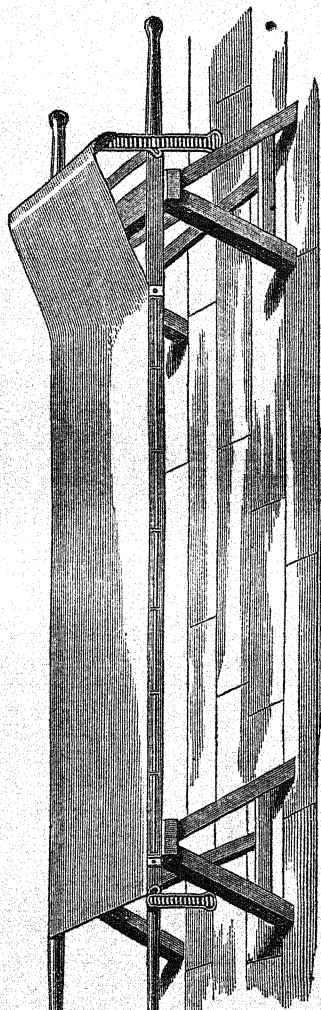
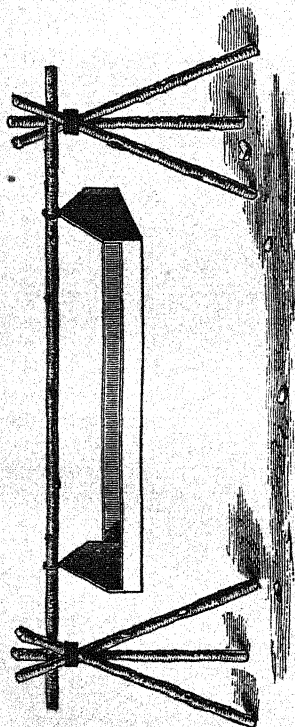
* In an unsuccessful landing the troops must rapidly regain their ships and the wounded must be left to the mercy of the conqueror.

FIG. 22.

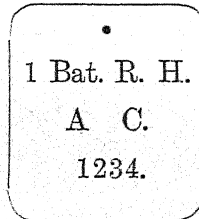


FIG. 24.

FIG. 23.



Some few important details with regard to the soldiers demand attention; amongst these we may notice the necessity of some means for identifying the killed and severely wounded. The American soldiers in the secession war were provided for this purpose with a parchment label hung round the neck; the Germans seem to have improved on this by substituting a small metal plate bearing the soldiers regimental number and the number of the battalion, regiment, and company he belonged to; with us for example, it would stand, as per accompanying figure. Should a soldier be killed, his label would be removed before burial; which would lead to the identification of his body, and would facilitate the preparation of a correct list of casualties.



1st Batt.
Royal High-
landers.
A Company.
No. 1234.

Every care should also be taken in noting all the particulars regarding each soldier admitted into hospital. The Americans used to take down the address of the parents, or in default of them, of the most intimate friend of each patient admitted.

It is acknowledged as desirable to furnish every soldier with the means for binding up his wounds; some, such as a small piece of linen with a bandage and some lint, can be stowed away anywhere, and may be kept in the trowsers pockets; this precaution may at times save a valuable life.

With a view to economize time, a parchment label should be affixed to the tunic of every wounded man examined by a Medical officer, stating the injury received, and dressing applied; a precaution which will dispense with a second examination.

Societies for the Help of the Sick and Wounded.

Dr. Longmore, in his treatise on the transport of sick and wounded says: "The hospital establishments of armies, the articles and necessary materials for the care and treatment of the sick and wounded among the troops, and the vehicles for their transport, have always been a source of difficulty and objection to military commanders, and they have become so more than ever since the progress of civilization and science has required the sick and wounded to be provided for in a manner more adequate to their necessities than formerly was ever contemplated." Even with the greater care now bestowed on this important subject, all agree that the means are quite inadequate to the wants. Dr. Evans remarks: "The accounts of all great battles prove that, during strategical evolutions, and especially after an engagement which has cost many lives, more men and a greater quantity of materials are required for the immediate assistance of the wounded, than any Government has yet been able to place at the disposal of its Army Hospital Corps."

In the German official account of the war of 1866 occurs the following passage:—"It was, however, proved here also that the fearful sufferings which war inflicts can only be insufficiently alleviated, and that no human arrangement can fully provide for the wants of an army after a great battle." Even with railways there will be generally a gap between an advancing army and the serviceable end of the railway; if this can be rapidly repaired after a battle, the trains can remove the wounded soon enough, otherwise good arrangements require to be

made for carriages, country carts, and all other available means to convey the wounded to the ambulance trains.

It is now pretty generally admitted that we must look to the charitable co-operation of the public to assist the sick and wounded, and the wars which have occurred since 1864 clearly demonstrate that the Geneva Conference was an acknowledgment of the insufficiency of the official sanitary service. A call was made on the general public to come to its assistance to alleviate human suffering, and this call has been generously responded to.

The patriotic and charitable societies which come forward so readily and generously to the help of the unfortunate sufferers in the wars of our days, working at their pleasure and according to what each considers most important for the moment, are too scattered and isolated to do all the good they are desirous of performing. These societies render a powerful assistance to the regular medical establishments of an army, and such is the vastness of the armies of the present day, that without their aid, the regular organized means would be utterly insufficient. The direction of all medical services, and assistance to the sick and wounded, however, should be one; if the voluntary societies will continue to assert their independence, a waste of power and serious inconveniences are sure to result. It would greatly increase their field of utility if they were all placed under the direction of the Surgeon-General of the Line of Communications, who would point to each the locality most in need of assistance, would furnish them with transport, rations, and forage, would facilitate their work, and include them in his calculations in arranging the whole of the means at his disposal for the execution of the work to be carried out. By not submitting themselves to the authority of the Surgeon-General of the Army, they will, moreover, never receive the instructions needed for their establishments to proceed to those places in which they are principally required. With no one to inform them of the actual circumstances, they will either remain stationary until too late, or take wrong directions, arriving only on the scene of action after many hours wasted in useless going backwards and forwards on wrong roads. Dr. Longmore wisely observes: "Really no such ambulance can be independent; if it follows an army, some of its requirements such as forage, rations, &c., must be met from time to time by grants from the authorities of that army, its position with the army must be one of sufferance. Better for all parties, and especially for the interests of the sick and wounded, that the personal aid should be given as supplementary to the establishments already organized, and be placed under such direction as will enable it to be turned to the best account." How very necessary their aid is is acknowledged by all; we quote again from Dr. Longmore: "Experience (he says) has shown that the most liberal scale of hospital attendance which any Government has yet adopted, has still fallen short of meeting the wants created by the emergencies of war." Dr. Innes thus expresses himself on the same subject: "In the tracks of armies there has always been a need of everything, no matter what foresight may have been exercised; for the victors, even if able to succour their own wounded, will also have on their hands large numbers of the vanquished, and in the first flush of a great engagement no help ever proved adequate to the requirements of a battle-field."*

The members of these excellent societies will themselves recognize

* "Modern warfare spares mankind these endless wars, crowding into a short space of time a sufficiency of misery and disaster to humble one if not both of the contending belligerents."—*Nautical Magazine*.

the fact that, like every other body on service, they must be subordinate to a supreme directing authority, for it is only possible for this officer to become acquainted with all the wants of the army, and, as to him all demands for assistance will be made, he must have at his disposal every available means with which to satisfy them. Let them, therefore, place the means entrusted to them by a generous public to the best advantage by subordinating their movements to the established medical authorities of the army, particularly as the 10th Article of the Geneva Convention points to his subordination. In the Franco-German War of 1870-71 we read that the German Government accepted largely of the services of the help societies, with the *matériel* and *personnel* which they offered, but always retained the most absolute command over everything; it thus avoided numberless difficulties arising from conflicts between the regular medical service and the auxiliary ones, which must always end to the detriment of the sick.

Advantage has been taken of the immunity the badge of the Red Cross secures to its wearer by scoundrels capable of any atrocity. For the credit of the badge, something should be done to prevent evil disposed people using it at pleasure.* Each person entitled to wear the badge should receive a properly qualified certificate, all people not able to produce it should be treated as malefactors. Sight seers should be made to understand that by the adoption of the badge at will they sail under false colours, and are liable to get into trouble. The military police should pay particular attention to this, as spies may prowl about under the safeguard of the Red Cross badge. In the Franco-German war, the Berlin Verein gave two cards with the *brassard*, one being a travelling card and the other a certificate of the possessor's right to wear it. Miss Florence Lees suggested a stamp for all nations alike on *brassard* and cards; the cards to be shown to the military or police authorities on demand under pain of arrest: a heavy fine to be inflicted upon every one found wearing the *brassard* without authority. The Surgeon-General of Communications, and his principal officers should keep registers of Red Cross certificates issued, and the societies themselves should expose any one wearing the badge without any right to do so. The Geneva flag has also been unworthily used to shelter places not containing sick from the enemy's fire; at other times complaints have been made that it has been fired upon, and that ambulance men have been wounded: if, however, ambulances will follow the combatants too closely, so as to come under fire, they must take the consequences, for they have no business under fire.

The best field for the volunteer aid would be on the line of communications, relieving as many as possible of the regular medical staff, and permitting their return to the field army where their services are most needed. After a battle, as the army moves forward, the only parts it leaves behind are the disabled and the hospital establishments rendered stationary by the influx of the first. The voluntary medical help should step in here and relieve the medical staff. It might then be found that the regular medical service would almost suffice for the field itself, though inadequate for the ever increasing service in the rear.

To show the assistance these societies render to an army in excess of medical aid, we can mention one case which occurred in the German War of 1866, when, after the battle of Sadowa, the Prussian Society for

* "There were many unauthorised personators of membership of the Red Cross Societies, and after Sedan the Cross was made to cover much smuggling of horses and arms, the spoils of the battle, over the Belgian Frontier."—*Dr. Janes.*

Help to the Wounded sent to the army, by one train alone, 50,000 lbs. of meat, 34,000 bottles of wine, 1,500 bottles of brandy, 20,000 pairs of slippers, 5,000 flannel belts, 62,000 cigars, &c. The Americans, who lost many men in the early part of the war of secession from want of sufficient sick carriage and attendants, as the war went on took a great interest in their sick and wounded, and subscribed more than 80,000,000 dollars for their relief. In America it was estimated that the help given to the sick and wounded during the war had preserved a multitude equal to an army of 100,000 men to the States. The Red Cross Societies have hitherto afforded little help to us in our small wars, but this perhaps was unavoidable, owing to the peculiar circumstances of the same.

We cannot omit saying a few words regarding the houses of rest established with such success by the Germans before Paris. These minor hospitals, partaking more of the barrack than of the hospital, were prepared for men who were not actually sick, but whose health was somewhat impaired by fatigue and privations. The cases would otherwise have been treated in hospital, the men being sent to the rear and lost for a time to the army. In the houses of rest they found quiet, repose, and good nourishment, and soon got restored to sound health. Surgeons experienced in all the ruses of soldiers examined every convoy of sick, and determined which men had to go to the hospital and which only to the houses of rest. The latter, when recovered had to attend only light drills, and soon finished by rejoining the army. These houses checked the tendency some soldiers have to escape from hardships and danger by going to hospital; if, however, in place of recovering, the patient got worse, he was forthwith despatched to the nearest hospital. In two and a half months the Germans reckoned that 7,000 men received and accommodated in these rest-houses entirely recovered, and rejoined their regiments before Paris.

In distant colonies sanitariums established in healthy localities, away from the theatre of operations, are very essential. In these sick and wounded may get re-established to sound health without being sent back to England, for it is very undesirable to send home any cases which may soon recover with quiet, change of air, and proper attendance. These soldiers are difficult to replace, and every effort should be made to lower the strength of the troops as little as possible. Great care should, however, be taken when soldiers recover, that none are sent to the front again whose state of health is at all doubtful, or who have shown any special tendency to sickness; plenty of places for these will be found in rear, where the fatigues are not excessive. As great danger is run where men pass at once from the comforts of a hospital to the arduous work in the field, their return to the field army should be gradual.

Detailed returns of all invalids embarked for conveyance home should be forwarded, if possible, in advance, by mail, to insure proper preparations being made for their reception and disposal on arrival.

CHAPTER VIII.

THE COMMISSARIAT AND TRANSPORT CORPS—INDIAN MOVEABLE COLUMN CARRIAGE—SIR MICHAEL KENNEDY'S PROPOSED RE-ORGANISATION OF THE LATTER—AMOUNT OF TRANSPORT EMPLOYED IN SOME OF THE PAST WARS—ASSISTANT-COMMISSARY GENERAL BAILEY'S ESTIMATE FOR WHEEL TRANSPORT—LIEUTENANT-COLONEL LOW'S ESTIMATE FOR PACK MULE TRANSPORT—CONSIDERATION OF CADRE AND SIZE OF SECTIONS FOR PROVISION COLUMNS—DEPOTS FOR SICK ANIMALS—REPAIRING PARKS—REGISTERS OF ANIMALS PURCHASED, HIRED, OR REQUISITIONED—CASH BOOK, PAY LISTS, AND DISCHARGE TICKETS.

At Home and in India we keep up a permanent transport, which may be employed in war by expanding it according to circumstances and the magnitude of the undertaking.

The Commissariat and Transport Corps consists of 16 service companies, and two dépôt companies, one Commissariat the other Transport. These companies in ordinary times are distributed for duty between the stations of London, Woolwich, Portsmouth, Aldershot, and the Curragh. Taking the latest establishments, namely those authorised for the 1st April 1881, (see Army Circulars 1st May 1881,) we find the strength of each service company to consist of 122 non-commissioned officers and men, with 63 horses; the commissariat dépôt company of 122 non-commissioned officers and men; and the transport dépôt company of 86 non-commissioned officers and men, with 63 horses. The Commissariat and Transport Corps, as it stands now, in peace time, therefore represents a total of 2,429 non-commissioned officers and rank and file, with 1,099 horses.

An inspection of the organization tables issued in 1877 would be misleading as far as the Commissariat and Transport companies for service are concerned, for these companies have undergone a considerable modification since then, whilst the tables have not been altered since their issue to show the change that has taken place. We have shown what the total strength of the Commissariat and Transport Corps is in peace time, according to the latest authorised establishments; now each company is organized on such a footing that, by the addition of certain details in taking the field, it can be readily divided into three parts, viz: head-quarters with first section, second and third sections. These three sections are mounted, but each one is completed by the addition of a dismounted detachment. The war establishment of each company consists of 144 of all ranks, with 18 riding and 58 driving horses; with an army corps in the field, four companies form the cadres of the transport of the 1st line, two of the 2nd line, and two are told off for the line of communications and base. After being raised to war strength, the cadres themselves undergo no alteration, but, as each section is detailed for special duties with some portion of an army corps, the men and horses in each section must necessarily be augmented according to the work they are called upon to perform. Thus, though the cadres of the eight companies will amount to 1,152 of all ranks, with 560 riding and draught horses, the total of these companies with an army corps in the field is estimated at 2,982 of all ranks, with 3,053 horses; the difference in drivers and draught horses between the cadres and the actual strength being made up from the reserves or by utilizing local means.

Until the publication of the revised organisation tables for the Commissariat and Transport, it is advisable to abstain from any further examination of the division of the eight companies amongst the component parts of an army corps, for we must await the issue of more correct information on several points than we possess at present. We recommend to our officers a study of these tables, when the revised ones are issued, as from them they will easily comprehend the intended employment of every portion of the Commissariat and Transport companies on service.

In India, where we maintain a large army, owing to the great extent of territory, to the state of preparation always needed when occupying a foreign country, to the necessity for moving troops at the shortest notice, to the constantly recurring expeditions and petty wars on the frontier, and, until quite lately, owing to the absence of railways, a certain quantity of transport is always kept up. The Indian transport, however, is purely a civil transport with no special military or semi-military organization, or sub-division into regular fractions; it is known as the moveable column carriage, and is principally devised to have the effect, by giving the troops more mobility, of reducing the number required for the effective occupation of the country.

From a lecture on the Military Transport and Supply in India, delivered at the Service Institution in June, 1872, by Royal Artillery, at the Royal United Service Institution, we obtain the following information regarding the strength of the moveable columns and the amount of transport required to move the different columns and the amount of arms of the service in that country.

According to this officer, the present scale of arms of the service in that country, fixed in 1861, and for the Bengal Presidency may be taken as constituting a force of—

“9 batteries, or 54 guns, with the first line of wagons only.
6 squadrons of British Cavalry.
9 ” Native ”
9 battalions of British Infantry.
12 ” Native ”

“The largest column in Bengal consists of—
1 battery of artillery.
1 regiment of British infantry.
1½ ” Native ”
1 ” ” cavalry.

“And the smallest of all arms of—
½ battery of artillery.
1 wing of a British infantry regiment.
1 ” Native ”
1 squadron of Native cavalry.”

“In Bengal there are 23 ‘moveable columns,’ and if we estimate those in Madras and Bombay together at one-third of the Bengal strength, we should have approximately a force of—

12 batteries.
8 squadrons British cavalry
12 ” Native ”
12 battalions British infantry.
16 ” Native ”

“Or, in other words, transport provided for a force equal to an Army Corps of 72 guns, 28 battalions of infantry, and 20 squadrons of cavalry.”

* * * *

“It will, however, give some idea of the extent of transport neces-

sary in India if I state that a regiment of British infantry equipped on this 'moveable column' scale requires about—

41 elephants and 280 camels.

A battery of artillery, 10 elephants and 74 camels ;

• A squadron of British cavalry, 7 or 8 elephants and 66 camels ;

A regiment of Native infantry, 112 camels ;

And a squadron of Native cavalry,* 9 camels."

From a Memorandum on Transport prepared in the office of the Quartermaster-General in India (dated Simla, 16th October 1879,) we gather some idea of the transport kept up in India as moveable column carriage, which the following table will show :—

"The following is the distribution of this carriage by divisions and districts :—

						Ele- phants.	Camels.	Bullocks.	Mules.
Presidency	..	..	..	..	..	119	..	183	..
Allahabad	..	..	..	..	..	..	298	..	..
Oudh	..	..	..	..	..	100	516	..	..
Sangor	..	..	..	..	..	55	63	864	..
Gwalior..	..	..	..	..	..	51	516	..	..
Rohileund	..	..	..	..	..	31	535	..	..
Meerut	..	..	..	..	..	55	687	..	..
Umballa	..	..	..	..	..	63	1,082	..	..
Lahore	..	..	..	..	..	69	905	..	..
Rawul Pindee	..	..	..	..	..	122	1,229	..	500
Peshawur	..	..	..	..	..	60	1,400	..	500
Peshawur Field Force	..	..	..	..	..	..	550	..	680
Poona	..	..	..	..	..	25	133	..	368
Northern Division	..	..	..	..	..	18	143	..	162
Belgaum	..	..	..	..	..	8	52	..	133
Mhow	..	..	..	..	..	27	403	..	474
Northern Division	..	..	..	..	..	..	..	42	..
Central	..	..	..	..	..	4	18	78	100
Southern	..	..	..	..	..	4	61	21	..
Mysore	..	..	..	..	..	8	109	21	100
Malabar..	..	..	..	..	..	52	..	74	..
Ceded districts..	..	..	..	..	..	5	146	..	100
Hyderabad	..	..	..	..	..	27	196	397	100
Nagpore	..	..	..	..	..	12	185	35	100
Burmah..	..	..	..	..	..	130	..	365	..
Total	..	..	..	..	..	1,045	9,227	2,080	3,357

The moveable columns are distributed all over the extensive territories of British India. The concentration of the transport kept up for their use, to be applied to any particular purpose, is hardly feasible, as long as the necessity for keeping these columns ready to move at the shortest notice exists.

The cost of the transport in 1879 was reckoned by the Army Organization Committee at 36,86,886 rupees.

It has already been shown, in Chapter III, how early in the month of April 1878, H.E. the Commander-in-Chief in India invited the attention of the Indian Government to the consideration of the question,

* The Native cavalry require less transport than any other body of troops in India, as by its organization each two troopers are bound to keep up at all times a pony for the purpose of fetching grass in time of peace, and transporting their tent, baggage and personal property on the march, both in peace time and on service.

how to provide a transport train out of the moveable column carriage for employment on foreign service. The late Afghan War has clearly set out the shortcomings of the Indian Land Transport, and a re-organisation of it will most likely be the result. Lieutenant-General Sir Michael Kennedy (Controller General of Supply and Transport during the Afghan War) has, in a very able memorandum, submitted his views as to the organisation he considers the Indian Transport should have. Our space will not permit us to show all the details of this scheme, which the military student can best master by a perusal of the General's memorandum, but the following is a brief sketch of its principal points:—

Sir Michael Kennedy proposes the abolition of the present moveable column carriage, to be replaced by a system of regimental and general army transport, the first being principally provided for those portions of the army which are liable to be called for service on the frontiers of India. He considers a full regimental mule transport should be assigned, 1st, to the Punjab Frontier Force; 2nd, to a portion of the army stationed in the Punjab; 3rd, to the force in Sind; 4th to the force on the Eastern and South-Eastern Frontiers; 5th, to the force in Burmah. These various forces amounting altogether to—

- 3 regiments of British Infantry.
- 21 " Native Infantry.
- 8 " Native Cavalry.
- 10 batteries of artillery.
- 3 companies of sappers and miners,

would need for transport purposes, 7,881 mules and ponies.

All British and Native Infantry regiments to be provided with a reduced regimental transport, at the rate of eight mules per regiment (one per company) for purposes of training. The 47 British and 110 Native regiments would need 1,250 mules and ponies for this purpose, making, with the full regimental transport as stated above, a total of 9,137 mules and ponies. The second class would have also eight light carts per regiment; or, in all, there would be 880 carts.

The General Army Transport he would assign to the following 15 main centres, all of them important military stations, strategical and political centres, and in most cases also important centres of commerce :

Bengal Presidency.	Madras Presidency.	Bombay Presidency.
1. Rawul Pindee.	9. Secunderabad.	13. Jacobabad.
2. Lahore.	10. Bangalore.	14. Mhow.
3. Meerut.	11. Madars.	15. Poona.
4. Agra.	12. Rangoon.	
5. Lucknow.		
6. Allahabad.		
7. Calcutta.		
8. Shillong.		

For 13 of these main centres he proposes a permanent transport of 500 mules, trained for draught and pack alike, organised in divisions of 250 animals, to be expanded to 1,000 each in time of need; 100 light carts, for draught by one mule; 200 heavier carts, for draught by two mules. At the remaining two (Shillong and Rangoon) a permanent transport of one division of 250 mules, and at each one division of coolie corps, 200 in number, to be expanded to 1,000 when necessary.

The 15 main centres, including Shillong and Rangoon, would contain a permanent transport as follows:—

7,000 mules for pack or draught.
 1,300 light carts for one mule or pony each.
 2,600 heavier carts for two mules or ponies each.
 400 coolies.

* The following table shows the aggregate amount of transport needed for this scheme* :—

————	Mules or Ponies.	Carts, light.	Carts, heavy.	Coolies.	Elephants.
Full Regimental Transport† ..	7,881	—	—	—	—
Reduced " " ..	1,256	880	—	—	—
General Army " " ..	7,000	1,300	2,600	400	400
	16,137	2,180	2,600	400	400

The above, in a few words, is the reorganization of the Indian Transport proposed by Sir Michael Kennedy. In No. 46, Vol. IX, of the Journal of the United Service Institution of India, this question is fully treated in the Gold Medal Essay by Lieut. E. G. Barrow, B.S.C., and in able articles by Major M. J. King-Harman, A.Q.M.G., and Captain W. A. Yule, Royal Scots Fusiliers; a study of these will well repay the military reader.

The Home and Indian transports alone afford us a nucleus, by the expansion of which a sufficiency of means may be secured. To be able to ascertain, with some approach to accuracy, the quantity of transport that will suffice for any intended operations is not so easy as it might appear at first sight; it is a matter of calculation in which a quantity of minute details must be taken into account. Though the circumstances of our wars and expeditions vary so essentially one from the other, that the experience gained in one particular case, with regard to the quantity of transport, is of little actual value in the next, still from the narratives of some of the last wars we gather some useful information on this subject of quantity with which it will be as well to become familiar.

De Fonblanque states that when the Land Transport Corps was formed in the Crimea it was calculated that to move 58,000 men, and 30,000 horses, with everything complete for 3 days, it would have required about 9,000 men, and 12,500 animals.

In the campaign in the North of China in 1860, for a force all told (including followers) of 22,000 men, with 6,000 animals, the transport consisted of—

Horse and bullock transport	2,500
Coolies 2,500 (or, at the rate of four coolies to one animal)	625
	<hr/> 3,125

Or one animal for each seven men.

* The cost of the proposed organization amounts to a yearly expenditure of 33,23,081 rupees.

† Elephants can be usefully employed on the Eastern and South-Eastern Frontier and in Burmah, and are absolutely necessary for supply purposes in these countries; where they are so used the Lieutenant-General recommends that an equivalent number of these animals be substituted for one-half of the regimental transport. The employment of 400 for general army transport is also deemed necessary.

Detachments of transport from the main centres are to be furnished to out-stations according to requirements.

As the army was marching parallel to a navigable river and means were taken to utilize the available water transport, the above figures do not represent the entire transport employed.

In the New Zealand war the strength of the transport varied with that of the force engaged. A return of the 1st May 1864, shows the strength of the troops to have been at that date 15,017 men, with 2,244 transport animals, or nearly one animal for seven men. In this war, again, we must notice two things; first, that a certain quantity of supplies and *matériel* were conveyed by water; secondly, that of the above numbers, only about 500 men were mounted.

In Grant's celebrated campaign of 1864, in Virginia, for an army of 125,000 men, he had a transport train of 4,300 carriages, each drawn by four horses or six mules, and 835 ambulance wagons, drawn by two horses, or, assuming that the carriages were mostly drawn by mules, which was the rule at the close of the secession war, transport at the rate of one animal for every $4\frac{1}{2}$ men. M. Vigo-Roussillon, *Intendant Militaire*, gives the following number of the effectives and transport carriages of the American armies in the campaigns of 1864:—

"Army of the Potomac, 1864. Effectives, 120,000 men, with 4,300 six mule wagons.

"Army of Tennessee, 1864. Effectives, 75,000 men, with 3,000 six mule wagons.

"Army of Sherman in Georgia, 1864. Effectives, 58,000 men, with 2,000 six mule wagons,"—one animal for every 4.6, 4.16, 4.8 men respectively.

In the Abyssinian expedition a return of the Quarter-Master General, dated 1st April 1868, shows a force of 12,601 combatants with 14,500 followers, or in all 27,101 men; at the date of the capture of Magdala the number of transport animals was given as amounting to 28,835 (of which 3,565 were sick), or more than one animal per man. The return of animals received in the transport train from the beginning to the end of the expedition from all sources amounted to 41,723,* and this number compared with the above, will show what the mortality, and losses by other causes, must have been amongst transport animals during the operations. In calculating the totals we must include the followers, for in unproductive countries their food has to be carried, and they require careful looking after just as much as the fighting men.

The Abyssinian expedition was an exceptional one, as the distance of the objective lay such a considerable way, about 380 miles, from the base. As the difficulty of transporting supplies in poor, barren, unproductive countries increases with the length of the line of operations, so will the difficulties of transport increase as the army advances. The animals have not only to carry supplies for the army, but also for themselves and their drivers, hence, as they consume a good part of their load, proportionately as the line extends in length, the amount of untouched supplies carried is reduced. With all the efforts to diminish the *impedimenta*, to add fresh pack-animals to the train, to obtain the assistance of carriers, both men and women, the supplies with the troops when Magdala was reached were barely sufficient. The Abyssinian expedition, for the very reason that it was an exceptional one and an extreme case, is deserving of a deep study, and this can be easily effected, as it is the only one of our expeditions of which a full, minute, and detailed account has been published.

Chanzy in his winter campaign in 1870-71, on the Loire, for an army of from 125,000 to 150,000 men, employed 4,500 carriages. This

* See Major Holland and Captain Hozier's "Expedition to Abyssinia," page 259, vol. ii.

number might have been reduced by one-third, but, the transport being all requisitioned, indifferent animals and carriages had to be accepted as there was no time for making a proper selection.

In the expedition to Khiva in 1873, the number of Russian troops employed amounted to nearly 11,000 men, who were accompanied by 19,200 camels, besides a large number of horses. The campaign depended entirely on the transport; camels, owing to scarcity of water, were principally employed for that purpose. That it nearly broke down, owing to an insufficiency of transport, is a well established fact.

In the Ashantee War of 1873-74, for 3,554 combatants, which were to invade the Ashantee territory from the secondary base on the Prah, it was calculated that about 4,000 carriers were needed.

The strength of the force with which the invasion of Zululand was attempted in the beginning of 1879, amounted, according to the official return of the 16th January, to 15,704 of all ranks, with 1,058 conductors, drivers, and foreloopers; in all 16,762 men, with 14,283 oxen, 801 transport horses, 401 mules, 932 wagons, and 56 carts.

In Europe one cart can carry what is necessary for 40 men; operating in wild countries every two or three men and followers must have an animal, sometimes more. In the Khivan expedition, under Prince Bekovitch Tcherkassky, a camel was allowed for every two men; in that under General Perovsky in 1839, every man had two camels, and every two men a three-horse cart.

Two officers who have had considerable experience on service as Directors of Transport have given us a detailed estimate of the amount of transport they consider necessary for a stated force with a fixed number of days supplies. As these estimates can prove useful to the military student, it is deemed desirable to allude to them here whilst considering the important question of quantity. The first estimate, by Deputy Assistant Commissary General Bailey, deals with wheel transport for a force of 8,895 officers and men, with six days' provisions and forage.

Estimate—Carriage for

Regiment of Infantry, say 800 strong.

	Lbs.
80 tents, with waterproof sheets, bill-hooks, and camp kettles for men, at 100 lbs. each	8,000
800 blankets, at $3\frac{1}{2}$ lbs. each	2,800
112,000 rounds of small-arm ammunition, being 140 per man, at 120 lbs. per 1,000 rounds	13,440
12 officers' tents, at 100 lbs. each	1,200
35 officers' baggage, at 100 lbs. each	3,500
Ambulances for carriage of sick, at 5 per cent. of the force, 40 men, equal to 200 lbs. each	8,000
Medical panniers and hospital comforts, say	1,200
	<hr/>
	38,140

Equal to 32 wagons, at 1,200 lbs each

Regiment of Cavalry, say, 400 men and 400 horses.

	Lbs.
50 tents, with waterproof sheets, &c., for men, at 100 lbs. each	5,000
800 blankets (one per man, one per horse), at $3\frac{1}{2}$ lbs. each	2,800
60 rounds of spare ammunition per man, 24,000 rounds, at 120 lbs. per 1,000 rounds	2,880
20 officers' baggage, at 100 lbs. each ..	2,000
10 officers' tents, at 100 lbs. each ..	1,000
Picket posts and ropes for horses, say ..	3,000
	<hr/>
	16,680

Equal to 14 wagons, at 1,200 lbs. each

A Battery of Artillery, say, 200 men and 160 horses.

	Lbs.
25 tents, with waterproof sheets, &c., for men, at 100 lbs. each	2,500
200 blankets for men at $3\frac{1}{2}$ lbs.	700
5 officers' tents, at 100 lbs. each	500
8 officers' baggage, at 100 lbs. each ..	800
Picket ropes and pins for horses	1,125
600 rounds of field ammunition, at 14 lbs..	8,400
	<hr/>
	14,025

Equal to 12 wagons, at 1,202 lbs. each

Royal Engineers, say, 400 strong.

The rate of half a regiment of Infantry .. 19,070

Equal to 16 wagons, at 1,200 lbs. each.

Royal Engineer Park (ordinary).

For Field Service 14,400

Equal to 12 wagons, at 1,200 lbs. each.

General and Brigade Staff.

Baggage and tents of, say 14,400

Equal to 12 wagons, at 1,200 lbs. each.

Thus—

	Officers and Men.	Chargers.	Wagons.
8 Regiments of Infantry (32 wagons per regiment)	6,400	100	256
3 Regiments of Cavalry (14 wagons per regiment)	1,200	1,200	42
4 Batteries of Artillery (12 wagons per battery)	800	640	48
Royal Engineers	400	30	16
Royal Engineer Park .. .. .	..	..	12
General and Brigade Staff	25	50	12
Commissariat Staff for 5 Brigades, including baking, butchering, and mining implements	70	10	25
Total	8,895	2,030	411

Commissariat Supplies.	—	Wagons.
Three days' provisions to accompany the Force—	lbs.	
27,000 rations provisions, at 3 lbs.	81,000	
6,090 rations forage, at 22 lbs.	133,980	
Three days' provisions and forage to follow the Force—		
Provisions	81,000	
Forage	133,980	
Total	429,960	360
		771
To this must be added 25 per cent. for casualties, as this branch will certainly sustain, from sickness, breakage, and other causes, more loss than any other part of the Force		193
Total		964

To work the 964 wagons it will take—

	Number of Horses.	Number of Men.	Wagons.
4 Horses to each wagon	3,856		
1 Man to a pair of horses .. .. .	..	1,928	
6 Non-Commissioned Officers to 20 wagons ..	..	289	
1 Riding horse to each Non-commissioned Officer	289		
1 Commissioned Officer to 20 wagons (mounted)	48	48	
A Senior Officer and Staff, to control, say 9 Officers, 18 Clerks; Officers mounted, each 2 horses	18	27	
Veterinary Surgeons, mounted	8	8	
Shoeing Smiths, 2 to 20 wagons, with 1 forge complete, drawn by 2 horses, and medicine chest attached.	96	96	48
1 Carpenter and harness-maker to 20 wagons, with cart drawn by 2 horses for tools ..	96	96	48
Total strength of Transport ..	4,411	2,492	1,060

Deputy Assistant Commissary-General Bailey provides in his estimate sick carriage for only 340 men, which is not 5 per cent. of the whole force; whereas it is generally considered necessary to make provision for 10 per cent. of sick.

Lieutenant-Colonel R. C. Low, Commanding 13th Bengal Lancers, furnishes the following estimate for mule transport in India: "Showing number of mules required for an army of 36,000 men, with fifteen days' supply of food:—

	Mules.
7,000 British Infantry, required	15,435
1,500 British Cavalry,	6,036
2,800 Artillery and Engrs.	11,267
4,000 Native Cavalry	9,900
21,000 Native Infantry	26,334
3 Total	68,972
Spare	1,028
	70,000

Abstract—

For carriage of troops	20,653
ditto 15 days' food	44,810
Spare animals.	4,537
	70,000

"The details from which above is taken are below. These calculations do not profess to be exact, or to show more than that the number given is ample. They will, however, be found to be approximately correct.

"The number of mules required for 1,000 British Infantry with carriage for fifteen days' food is 2,205, as follows:—

	Mules.
For carriage of kits	350
Tentage	90
Hospital	15
Guard tents	3
Cooking utensils	14
Tools	20
Medical stores	4
Arms of sick	10
Officers and men	40
Ammunition	200
Armourers	10
Quarter Masters' stores	15
Tentage and baggage for followers and kahars, say, 1,000 men	82
	<hr/> 853

Food—15 days' supply for 1,000 men, and 1,000 followers, about 950 maunds	475
15 days' supply for 853 + 475 mules = 1,328, at three seers	747
	<hr/> 1,222
Spare animals	130
	<hr/>
Total	2,205

"The number of mules required for 1,000 British Cavalry with carriage for 15 days' supply, is 4,024, as follows:—

	Mules.
As for British Infantry	2,205
<i>Additional—</i>	
Tentage and baggage for 500 syces and food for them for 15 days	135
Food for 1,000 horses for 15 days	750
Food for 500 ponies	180
Food for additional 1,159 mules	650
	<hr/>
Total	3,920

"The number of mules required for 1,000 Artillery is, as for Cavalry, 4,024.

"One thousand Native Cavalry require, 2,475, as follows:—

	Mules.
As for two { Officers and men	80
regiments of { Hospital	20
500 each { Quarter-master's stores	} 80
{ Horse hospital	
{ Forge	
{ Ammunition	100
	<hr/> *260

	Mules.
Food—15 day' supply for 1,000 horses	750
500 ponies	180
1,000 men	375
500 grasscutters	
100 followers	
400 kahars	
1,665 mules	830
	— 2,135
	<hr/>
	*2,475

“ One thousand Native Infantry require:—

	Mules.
Officers and men	80
Hospital	20
Quartermaster's stores	40
Men's tentage, followers and kahars	80
Tools	10
Ammunition	200
Food for 15 days for all	285
Spare	80
Food for 815 mules for 15 days	459
	—
Total	1,254

“ Carriage for animals' food has not been allowed in the cases of animals carrying food for others, as unloaded animals would not be taken on, but sent back to bring up more supplies.”

Our organization tables show by what augmentation of the present home transport it is proposed to provide on service for the conveyance of baggage, camp equipage, intrenching tools, infantry and artillery reserve ammunition, field hospitals, a limited amount of sick and wounded, bakery and butchery columns, and two days' provisions for an army corps; what, in fact, may be taken as the known quantity. No provision is made in these tables for rations and forage for more than two days for a total of 36,993 men and 12,849 horses; in short, the composition and strength of the provision columns are not considered therein. In the German Army these form part of the organization of each army corps, thus each has five *Proviant Colonnen* of 30 military 4-horse wagons and five *Fuhr Park Colonnen*, each of 80 wagons, hired, bought, or procured by requisition, and generally drawn by two horses. The first carry four days' rations for men, the second six days' rations for men and corn for horses. Each German army corps is thus followed by a total of 550 provision carriages, drawn by 1,400 horses.

Unlike other European armies, ours has no fixed knapsack reserve; indeed in most of our wars the soldier's knapsack is carried for him: the provision reserve taken into account (see tables issued with Army Circulars, 1st December, 1877) is limited to two days' supplies carried by the regimental transport and by that of the 1st line. We have no properly laid down field magazines, nor have we arranged for those mobile magazines which are indispensable for replenishing what is consumed by the army in all cases, but more especially when little or nothing can be procured in the country the army is operating in.

The organization of everything connected with the supply of an

* *Sic.*, in Published Papers, the total should be 2,415, not 2,475.

army in the field demands to be carefully studied and well thought over in time of peace, thus only can we hope to secure a good working system for use in time of need and pressure. It is not for us to consider here the best way of obtaining supplies, we limit ourselves to study the most effective way of moving them.

Regimental and departmental transport are, as a rule, properly constituted, fractioned into manageable parts, and endowed with sufficient supervision, but this is not the case with the auxiliary transport; this large collection of transport must be at once taken in hand and organised to satisfy in the most effective way the wants for which it is raised. Our organization is silent, as we have said already, on the subject of provision columns and moving magazines (composed principally of auxiliary transport), still it is most important to have some guide by which, given the number of the troops to be employed, the distance to be traversed, and the probable duration of an expedition, we may, taking into account the productiveness of the country, the capabilities of the local transport, etc., ascertain at once what number of wagons or pack animals will have to be provided for the transport of provisions. Notwithstanding the varying circumstances of our wars, this is an arrangement not to be left for consideration at an extraordinary busy time. The amount of conveyance for food and forage, and for sick transport, of course depends greatly upon circumstances, a rigid adherence to any organization scheme therefore could never be expected; the scheme itself should be accepted in the main as a basis, being modified to suit the circumstances of each particular case; this is not as difficult as starting a new one at short notice and at an unpropitious moment. With this end in view, let us consider what is the most suitable size for a section of the general transport, so as to arrive at some fixed unit of organization; this can be obtained by basing its dimensions on what is needed for moving a number of days' rations and forage, in every respect complete, for a given portion of an army: where the fraction is large, *p.e.*, an army corps, it will answer better to assign to it several uniform sections, than to use an unwieldy large mass. The size of the sections having once been settled, a suitable cadre can be assigned to them; thus, in the event of a demand for extraordinary transport means being made, cadres would be set on foot at once, each being required to organize its own section, an arrangement which would secure a division of labour and economy of time in the preparations. We would obtain by this organization uniform sections (which should as much as circumstances will allow be maintained at a standard strength), and we could thus at any moment arrive at the strength and capabilities of our transport. A manageable section should be of such strength that an officer may completely extend his supervision over all the details connected with the same. It should not be unwieldy and occupy too extensive a length in column of route. Should be divisible in equal fractions, so as to employ parts of it only when the whole is in excess of the requirements. The number of animals more than the number or description of vehicles should be taken into account, as the latter will vary much in description, whereas the power of draught and capabilities for burden is a more even and uniform quantity to calculate.

Taking a Division (which is a convenient numerical quantity, as it approaches most to the strength of the expeditionary forces we have employed in such countries as Persia, China, New Zealand, and Abyssinia) as the basis of our calculations, we find in one a total of 10,154 men,* with 2,450 animals, where wheel carriage only is used. Assuming

* See organization tables issued in December 1877.

the ration at 3 lbs. a-day (which is above the mark when slaughter cattle are driven), we find 30,462 lbs. of food necessary for each day; whilst the grain required for the riding and draught animals, at 10 lbs. per ration, will amount to 24,500 lbs. Thus, each day's food and grain for a Division amounts to 54,962 lbs., demanding 49 carts, or 172 camels, or 344 mules. It is assumed for purposes of calculation that a pair-horse cart, which will carry half a ton (1,120 lbs.) is used, carts drawn by two mules or bullocks will carry considerably under it.

Taking a ten days' supply as a suitable quantity to move at a time, we find 490 two-horse carts are required to convey provisions for a complete Division for that number of days. Adding 30 spare, we obtain 520 carts, which would give two very fair sized sections of 260 carts each. In the same way with pack animals, a ten days' supply for a Division requires 1,720 camels; allowing about 10 per cent. spare, we obtain two very fair sections of 940 camels each. With mules, 3,440, which with 340 spare will give 3,780 animals, fairly sub-divisible into four sections of 945 mules each. On this calculation of ten days' supply for a Division we might fairly establish therefore the strength of each section of the general transport as follows:—

Two-horse carts	..	..	..	..	260
Camels	..	..	..	..	940
Mules	..	..	..	..	945

Having accepted the strength of each section as above to be of a convenient size, we must proceed to consider the cadre which such a section would require for its efficient supervision and maintenance, namely, what officers, veterinary surgeons, conductors, non-commissioned officers, artificers, etc., should be detailed to work with each. Each section of 260 pair-horse carts might be divided into five sub-sections of 52 carts each, each sub-section to consist of four squads of 13 carts. A suitable cadre might stand thus:—

One Commander, 1 Veterinary Surgeon, 1 staff-sergeant, 1 clerk, 1 farrier-major.

2 saddlers	..	} which might be natives of the country, where skilled men can be obtained.
2 collarmakers	..	
5 wheelers	..	
5 shoeing-smiths	..	

For each sub-section, 1 conductor or sergeant = 5.

„ squad, 1 corporal = 20.

For a section of camels the following cadre might secure proper supervision:—

One Commander, 1 staff-sergeant, 1 master packer, 1 clerk, 2 solutries or native vets., 5 saddlers.

For each sub-section of 188 camels, 1 conductor or sergeant = 5.

„ squad of 47 „ 1 corporal = 20.

The cadre for a mule section would be very like the above, viz.:—

One Commander, 2 Veterinary Surgeons, 1 staff-sergeant, 1 master packer, 2 farrier-majors, 1 clerk, 10 saddlers, 10 shoeing-smiths.

For each sub-section of 189 mules, 1 conductor or sergeant = 5.

„ squad of 47 „ 1 corporal = 20.

With regard to provision columns, we have to consider how best the supplies can be carried. These can be arranged in two ways, each description of provisions being loaded on separate wagons, or each wagon being loaded with a mixed supply of those articles which constitute the daily ration. The disadvantages of the latter plan, the greater time needed for loading and a small loss of space, are more than balanced by the greater ease with which the distributions can be effected, as complete rations can be pushed up to the troops, instead of

the troops having to proceed to the commissariat parks to receive their allowances, which must generally occur when wagons carry only one description of supplies.

In examining the organization tables issued with Army Circulars the 1st December, 1877, (pages 6 and 11) we find that two 4-horse wagons are calculated to carry a mixed supply of provisions for one day for 1,097 infantry, and two likewise for 653 cavalry with 615 horses; each wagon being loaded with from 1,962 to 2,411 lbs. of provisions, besides the equipment. These tables are as follows, and show of what provisions the loads consist of when 4-horse wagons are used:—

DETAIL of loads for Wheel Carriage for One Days' Provisions and Grain. *

FOR A REGIMENT OF INFANTRY.

(Each Wagon—2 Drivers, 4 Horses.)

	One Wagon.		One Wagon.	
	No.	Gross Weight.	No.	Gross Weight.
		lbs.		lbs.
Preserved meat boxes	16	880	15	825
Biscuit bags	6	618	5	515
Tea canister	1	14	..	..
Coffee case .. .. .	..	..	1	40
Sugar cases	1	60	2	120
Salt canisters	2	25	1	13
Rum, 10-gallon kegs	1	119	1	119
Oat sacks	1½	250	2	330
Gross weight of provisions .. ..	..	1,966	..	1,962
Gross weight of equipment .. ..	..	84	..	84
Total weight	Cwt. qrs. lbs. 35 2 23		Cwt. qrs. lbs. 35 2 19	

* These tables were framed for horse draught; Sir Garnet Wolseley, when in the Transvaal in 1880, issued a General Order (No. 119, Army Head Quarters, Pretoria, 8th January, 1880), modifying them so as to make them applicable to the transport of the country.

FOR A REGIMENT OF CAVALRY.

(Each Wagon—2 Drivers, 4 Horses.)

	One Wagon.		One Wagon.	
	No.	Gross Weight.	No.	Gross Weight.
Preserved meat boxes	10	lbs. 550	9	lbs. 495
Biscuit bags	4	480	3	306
Tea canister	1	8	..	..
Coffee case .. .. .	..	..	1	16
Sugar cases	1	60	1	60
Salt canisters	1	13	1	13
Rum 5-gallon kegs	1	60	1	60
Oat sacks	8	1,312	8	1,312
Gross weight of provisions .. ..	..	2,411	..	2,262
Gross weight of equipment .. ..	..	132	..	132
Total weight	Cwt. qrs. lbs. 40 0 12		Cwt. qrs. lbs. 38 3 3	

Batteries of Horse and Field Artillery have one wagon with four horses for one day's rations and forage.

The following tables show the distribution of nearly the same amount of provisions and forage when pack transport is employed.

DETAIL of Loads and Pack Transport for one day's Reserve Rations
(Colonel Annesley's Committee, 8th July, 1880.)

Number of pack animals.	Number and nature of packages on each animal.	Gross weight of each package.	Weight of supplies in each package.	Total quantity of supplies carried.	Total number of rations carried.	Weight of pack saddlery with waterproof cover and line-gear for each pack animal.	Total weight of each load.
		lbs.	lbs.	lbs.		lbs.	lbs.
10*	2 boxes Preserved meat..	84	60	1,200	1,200	53	221
12	" Biscuit	78	50	1,200	1,200	53	209
10	2 bags.. Oats	84	80	1,600	160	53	221
1	2 boxes [Compressed tea, salt, and pepper]	55	31	62	1,120	53	163
1	" Sugar	96	70	140	1,120†	53	245
2	2 barrels Rum	69	50	200	1,280	53	191
			or 5 gals.	10 gals.			
36	Total pack animals for an Infantry regiment.						

* When meat is driven, these pack animals will not be required.

† This being a heavy load, the picketing equipment, driver's kits, nose bags, etc., will be carried by the other grocery animals.

N.B.—The food of the native drivers and staff has not been provided for in detail, as it would vary greatly with the countries in which operations were carried on.

FOR A REGIMENT OF CAVALRY.

Number of pack animals.	Number and nature of packages on each animal.	Gross weight of each package.	Weight of supplies in each package.	Total quantity of supplies carried.	Total number of rations carried.	Weight of pack saddlery with waterproof cover and line gear for each pack animal.	Total weight of each load.
		lbs.	lbs.	lbs.		lbs.	lbs.
6*	2 boxes Preserved meat..	84	60	720	720	53	221
7	" Biscuits	78	50	700	700	53	209
46	2 bags.. Oats	84	80	7,360	736	53	221
1	2 boxes {Compressed tea, {salt, and pepper}	37	18	36	672	53	127
1	" Sugar	60	42	84	672	53	173
1	2 barrels Rum	69	50	100	640	53	191
			or 5 gals.	or 10 gals.			
62	Total pack animals for a Cavalry regiment						

* When meat is driven, these pack animals will not be required.

The gross weight and number of rations in each unit of load for pack animals is as follows:—

	Gross weight.	Contains rations for.
1 box preserved meat	84 lbs. ..	60 men.
1 " biscuit	78 " ..	50 "
1 " tea, salt, and pepper ..	55 " ..	560 "
1 " sugar.. ..	96 " ..	560 "
1 barrel (5 gallons) rum ..	69 " ..	320 "
1 bag of oats	84 " ..	8 horses.

The consideration of the most convenient weight and shape of package is of much more importance than it appears at first. If the loads are reasonable and made up with a view to a possible transfer from wagons and carts to pack animals a great difficulty and loss of time will be obviated. With regard to certain loads for pack animals made up in rectangular cases, and sometimes lined with tin, it appears to us that a pair of panniers or wickerwork *ceste*, as used with pack animals in Italy and in other countries, would be preferable to cases. The loads can be better balanced, are easier secured and cannot shift; the animals can be loaded quicker, and the weight of the panniers is less than that of wooden cases. Panniers and basketwork of sorts get into a shape which adjusts itself to the animal. In most pads, saddles, etc., the weight is not evenly distributed along the back and presses on a small spot, with baskets and panniers the broad surface next to the saddle prevents this. The reason adduced in favour of cases that these can come in handy for firewood and for holding water when tin lined, is in itself insufficient; the amount of firewood obtained from this source is trifling. It would appear, therefore, preferable to send out large packages, which are better suited for sea transport than a large quantity of smaller ones, and to distribute their contents at the

base into panniers. The panniers are not costly, can be easily obtained, and men to repair them, or even to make new ones, can be found in many countries.

Dépôts for Sick Animals, and Parks for repairs.

Severe and continuous work in all weathers will tell on both animals and *matériel*; two important points, therefore, to attend to in the formation of a large transport for active service are the establishments of proper dépôts for the treatment of sick animals and of magazines where can be stored all kinds of *matériel* needed for replacements, and where repairs can be properly executed.

We have already said in a former chapter that animals incapacitated for work through sickness should be handed over to the care of the Veterinary Surgeons, and this leads us to say a few words on the establishments necessary on the line of communications for the reception and treatment of sick animals. Not only the expensive well bred war horse, but also the humble transport animal, whose services we so largely avail ourselves of during a campaign, deserves in return attention to his ailments which have originated or been aggravated by the heavy and continuous work we have been compelled to impose on him. To secure this attention proper establishments must be organized at convenient intervals on the line of communications, each one under charge of a Veterinary Surgeon, with a suitable number of farriers, shoeing smiths, attendants, and all the necessary medicaments and appliances.

These dépôts must keep pace with the formation and expansion of the transport, and should not be an after thought, called into existence only when the number of sick animals has increased to an inconveniently large figure. Dépôts for sick animals should be of two descriptions, large and small. The small ones are pushed up close to the field army and take charge of all fresh cases; to the larger ones in rear should be passed from the smaller ones all those animals whose recovery is principally a matter of time, or the debilitated ones for whose complete recovery good and substantial nourishment is necessary, and such as the small dépôts cannot furnish. In the expedition to Abyssinia, where the transport was on a very vast scale, and where insufficient and bad forage caused great sickness amongst the transport animals, dépôts for their reception and treatment were formed along the line of communications at places 75 miles apart.

Our regulations for the organization of the line of communications, though they take into account the reception of sick horses at the remount dépôts, are silent with regard to the transport animals; but inasmuch as bad and insufficient food often paves the way towards the spreading of contagious diseases amongst horses (and on service they will not be in the best state to withstand it) the necessity of preventing, by all proper attention, a serious epidemic amongst the numerous transport cattle on service, which would undoubtedly spread from them to the troop horses and be very difficult to arrest, does not need to be pointed out; hence the great importance of dépôts for sick transport animals. Undoubtedly, for a numerous army, large cadres for these dépôts are indispensable, but for our small expeditions or wars, where the force does not amount to above a Division, one Inspecting Veterinary Surgeon to supervise the whole, with Veterinary Surgeons, farrier majors, farriers, shoeing smiths and cattle doctors, proportionate to the number of animals to be treated at each dépôt, will suffice; the animals being attended to by natives of the country, where men

accustomed to the care of animals can be specially entertained for the purpose.*

A supply of medicines, instruments, and other requisites should be provided at an early stage from the store at the disposal of the Inspecting Veterinary Surgeon, so that, owing to an absence of proper and sufficient means, no delay may take place after the formation of a *depôt* in commencing to work.

The wear and tear of the transport *matériel* will be very considerable during the course of a campaign; this will demand the formation of establishments for the repair of carriages, harness, saddlery, gear, &c.† On the Sukkur-Quetta line of communication during the second Afghan War, though every care was taken to keep the good, strong, and well-seasoned carts in working order, one writer has told us how, notwithstanding the binding of grass round the naves and spokes of the wheels, the frequent moistening of the same, and other precautions, the burning blasts of the Cutchee Plain in the hot months of the year rendered a large quantity of carts continually unserviceable, and necessitated the formation of a considerable repairing *depôt* at Much, in the Bolan Pass. Again, in South Africa, when a transport train had to be organized for the operations against Secocoeni, it was found that many of the wagons used in the then just concluded Zulu War had materially suffered from the effects of the alternate exposure to heavy rains and a burning sun, demanding considerable repairs before being available for any further use. What happened in these two wars is a fair example of what generally will be the case; where there is much wheeled transport, artificers are absolutely necessary, and, without repairing parks, a proper transport cannot be kept in a thoroughly efficient state; these should be provided for from the very commencement of the operations.

These repairing parks have charge of maintaining the carriages and equipment of the army transport in efficient order by executing all the larger repairs to which the artificers attached to the various sections of the transport corps cannot attend. Each army corps should have its own repairing park, a reserve park of larger dimensions being established in rear of the army in some suitable locality on the principal line of communications. This last should be stationary, and should contain spare wheels, poles, shafts, axles, springs, harness, pack-saddles, and a good supply of all other articles necessary to replace damaged or lost ones. It should attend to all repairs which cannot be done by the parks moving with the army, and even undertake any new constructions which may become necessary. Being in communication with the army and the base, through it should be transmitted the materials required for repairs by army corps parks and by the artificers attached to the various transport sections.

The following establishment for an army corps repairing park would be sufficient for all requirements.

- 1 Officer in charge.
- 1 Staff sergeant.
- 1 Superintendent of works.
- 1 Clerk.

* The number of Veterinary Surgeons, farriers, shoeing smiths, and artificers usually employed on service is quite insufficient. The provision of a sufficient number of them should be considered at the very outbreak of the war.

† At the great *depôt* of the Federal armies operating against Richmond, at City Point on the James River, there were 1,800 carpenters, smiths, cartwrights, saddlers, carters, and workmen. In one year 3,653 carriages and 2,414 ambulances were repaired; 19,618 horses and 31,628 mules were shod.

Number of carts or animals to be paid.	Rate of pay for each.	Date of payment.	Amount paid.	Up to and for what date.	Initials and remarks of paying officer.

The *Register of Transport* book should be a record of all animals and carriages, purchased, hired, or requisitioned, showing casualties, discharges, losses by capture, &c. Carts and pack animals should be entered under separate headings; likewise those purchased should be shown distinct from the hired ones.

CARRIAGES PURCHASED

Showing particulars of purchase.

Successive number.	Number given to Wagon or Cart.	Description of carriage and of draught animals.	Name of Driver.	Where purchased.	Date of purchase.	Price paid.	Section told off to	Remarks showing transfers, discharge, loss by capture, desertion, etc.
1	220	2 wheeled Arabah, 2 bullocks.	Mahomed Khan.	Adrianople.	1/1/82.	£7 10s.	A.	

CARRIAGES HIRED.*

Showing any special agreement at entertainment, and all subsequent eventualities.

Successive number.	Number given to Wagon or Cart.	Description of carriage, and of draught animals.	Name of Owner.	Name of Driver.	Village or Town.	District.	Rate of Hire.	Date of entertainment.	Section told off to	Remarks.

* The nature of the contract for hired animals to be shown in column of remarks. A similar register for carriages requisitioned.

PACK ANIMALS PURCHASED.*

Successive number.	Number assigned to the animal.	Date of purchase.	District or place of purchase.	Amount paid (or average in a large number).	Load fit for heavy or light (H or L).	Purchased with pack saddle and equipment, or not.	Section told off to	Remarks.

* A similar Return for animals hired or requisitioned.

Cash Account Book.—The cash account book should be a common single entry book with a debit and credit account kept on opposite pages, balanced at the bottom, the credit or debit carried forward from page to page.

Pay List.—For payments a pay sheet is the best for all purposes, ruled in different columns, showing the weekly payments made to each man, and a column of totals. The pay sheet may, as soon as closed, be sent to the accountant branch in rear, an entry being made in the cash book of the amount issued as payments, with a note of the number of the pay sheet, date, &c.

Discharge Tickets.—On the completion of a certain specified service a discharge certificate should be furnished to each owner or driver of auxiliary transport to save him from being pressed on his return to his home.

To all whom it may Concern.

This is to certify that _____ who was employed with _____ from _____ to _____, has been permitted to return to his home at _____ with his property, consisting of _____. He is not to be compelled to render further services, unless very urgent circumstances demand it.

(Signature of officer)

CHAPTER IX.

DUTIES OF TRANSPORT OFFICERS—CORDIAL CO-OPERATION WITH VARIOUS DEPARTMENTS NECESSARY—REGISTER OF ANIMALS AND MATERIAL—BRANDING—CARE REQUIRED IN HARNESSING AND LOADING—LINE OF MARCH—PICKETING—BLANKETS—FEEDING—WATERING—GROOMING—DUTIES IN THE LINES—STORAGE OF FORAGE—PAYMENTS—RETURNS—JOURNAL OF WORK DONE—TUITION OF SOLDIERS IN PACKING AND LOADING—TREATMENT OF SICK ANIMALS—BAGGAGE MASTERS—THEIR DUTIES—CONVOYS—PROPER ARM OF THE SERVICE FOR ESCORTS—ANIMALS BEST SUITED FOR SPECIAL CASES—HOW CONVOYS SHOULD MOVE—PRECAUTIONS NECESSARY ON APPEARANCE OF THE ENEMY—PARKING RESORTED TO ALIKE IN ANCIENT AND MODERN ARMIES—DESCRIPTION OF A LAAGER—MOST SUITABLE FORMATIONS FOR DEFENCE—ESCORTS, HOW TO MOVE—MARCHING BY NIGHT TO BE AVOIDED—UNDESIRABLE IN BAD WEATHER.

Duties of Transport Officers.

MUCH of the transport used in war being raised generally at short notice, to permit it to assume without delay those proportions which economy forbids retaining in peace time, can only with time perfect its organization, and become thoroughly efficient; this time is often wanting, for the operations may not extend beyond a few months. At the very commencement of a campaign there is always a difficulty in obtaining officers for the transport who have a fair knowledge of their new duties, but unless the officers so employed can perform their duties at once in an efficient manner, they will add to the many difficulties of this service; hence it appears desirable to set before all officers a brief summary of the principal duties of transport officers on active service, that those who may desire to fit themselves for the transport branch may be able to acquire a knowledge of the main points they will have to attend to, and thus prepare themselves before the commencement of hostilities for the performance of transport duties.

A handy code of instructions to suit the peculiar circumstances of each case is indispensable, and should be in the hands of the Transport Officers from the very commencement of the operations. Attention is drawn to the following points, from which such a code could be easily prepared, the necessary additions to suit circumstances being introduced to render it complete.

Transport officers should never lose sight of the real business of the transport; they should devote themselves to carry out to the uttermost the main object for which transport is raised, wasting no time in what is superfluous, such as excessive grooming and cleaning up of equipment, useless parading, unnecessary drilling, etc. Those in charge of transport divisions are responsible for their divisions with respect principally to the health of the men and animals, payments, rations, and forage; serviceable state of harness, saddlery, wagons, and gear; discipline in camp, and on the line of march; regularity of duties and punctuality in the hours of departure. In short, they should attend to all those details which, by keeping the men in health, the animals in working condition, and the *matériel* in good repair, will secure real economy in a most expensive branch of the service.

When detailed for duty with the different departments of the army, the supervision of their divisions is their special work; in other respects they must readily comply with the instructions they may receive from the officials of the department they are attached to with regard to the description and quantity of stores, etc., they are to convey, and their destination. It is necessary for them to cultivate a cordial understanding with the officers of the different branches of the army, as petty jealousies and quarrels can only obstruct the smooth and efficient working of the various departments so very essential on active service.

The officers cannot attend to everything themselves, they should have able and active subordinates to assist them, and the work should be apportioned in such a way that every one has his full share of it. Each transport stage requires an establishment, and, though this can only be fixed according to circumstances, it should be provided without delay as soon as the locality for the stage has been determined upon.

No animal should be worked immediately after disembarkation. Animals after a long sea journey must be allowed to recover their strength gradually.

All animals for the Transport Corps should be branded—horses, mules, and ponies on the near forearm, camels on the near side of the neck, and bullocks on the near haunch—and a register should be kept by officers commanding divisions of all animals, wagons, saddlery, gear, and other public property in their charge. All harness, if possible, should be stamped, and all carriages marked with the number of the division, brigade, or regiment, they are for the time attached to. The branding should be done at the base, or original formation dépôt; for remounts at the veterinary establishments on the line of communications. Before the animals leave the base or formation dépôt they should also be carefully shod: if an animal has not been shod before and can do without it, the shoeing had better be omitted.

Likewise at the base or original formation dépôt, the saddlery and harness should be separately fitted to each animal, and once fitted never changed, except with very good reason. If the pack-saddle hurts a pack-animal, the defects should be corrected in preference to changing the saddle. On the degree of attention bestowed on the fitting of the pack-saddle for the first few marches will depend the future efficiency of the animals; some officers even recommend keeping the saddles on entirely for some days at first, in order both to accustom the animal to bear the pack-saddle and to cause the latter to get fitted to the shape of the animal's back.

Pack-saddles should be furnished of different sizes, as those designed for horses are not likely to fit mules with a different formation of body. The preservation of the animal from sore backs depends more on a careful arrangement of the stuffing of the pads and in the skill and attention of those in charge of the animals, than on the pack-saddle itself. With work the stuffing of the pads yields and becomes more flat, until the iron trees work down on the withers, and cause bad sore-backs. If possible, before taking the field, the pack-saddles should be used, and the stuffing shifted to suit the shape of the animals. The stuffing should be altered, also, whenever the animal loses condition from work, or from poor forage.

Transport officers are responsible that no transport of whatever description is despatched on duty, otherwise than in a serviceable condition, no animal with the slightest back or girth gall, or lameness, should be worked, all such should at once be turned over to the care of the Veterinary Surgeons. Sick drivers and animals should be sent as soon as an opportunity offers to the nearest dépôt, with a statement, for

delivery to the officer in charge, showing when the man was last paid and rationed, and all articles of public property with both men and animals. Drivers should have no inducement to over-work and break down their animals so as to remain in rear, and have an easy time of it whilst their animals recover. Special men should be told off to collect and attend on non-effective animals, the drivers moving on with the rest. Animals suffering from infectious diseases should be at once isolated; rubbers, numnahs, blankets, etc., used for such animals being invariably destroyed.

Transport should be worked economically; when carts and animals are in excess of the requirements, an immediate report should be made to the Director, instructions as to the disposal of the surplus being demanded. In the staging system, working small sections, a conductor or non-commissioned officer will be sufficient on the march to look after each section. Transport officers, whilst supervising their entire divisions in the most efficient way, should abstain from performing small duties which can be as well performed by a conductor or non-commissioned officer, as this would lead to a waste of their time, besides being too expensive, and in the long run requiring the employment of too large a number of officers.

Full loads, with a large percentage of spare animals, is more economical than light loads with a small percentage of spare. The spare animals should be distributed along the line of convoy. Their drivers should pick up the broken down animals after their loads have been transferred to the spare animals, and bring them into camp. Spare animals on the march are not, on any pretext, to be used for any other purpose than for the relief of distressed animals. Officers of Transport are answerable that nothing in excess of the weight fixed for each description of transport is carried, for which purpose the weight of all loads and packages should be clearly painted on them. Weigh-bridges are useful to ascertain the weight of loads on wagons and carts, but will seldom be found on service. Where there is a break in the description of transport necessitating the fractioning of large loads into smaller ones, this division should be undertaken at the base, where it can be performed in a more efficient way than further forward.

As the weight of an animal's burden should be proportionate to his condition and strength, commanders of divisions or sections should report to their superiors if the scale of loads, owing to insufficiency or inferior quality of forage, the length or difficulty of the marches, or the nature of the climate and country, appears in excess of the powers of the animals with due consideration to their future efficiency. A similar report to be made if the cattle appear overworked, and to require rest, so that steps may be taken for the animals to be replaced and sent to the grazing depôts.

The superintendents and drivers should be instructed in the proper loading of pack animals. Particular attention before starting should be paid to the harnessing and loading; the superintendents should attend to the girthing of saddles, and the harnessing of the animals of their respective squads before these leave the lines. With pack animals the presence of any extraneous substance between the hide of the animal and the panel of the pack-saddle will cause galls; the drivers should therefore see that the panels are quite clear before saddling. The load should be placed high up and well over the arches of the ribs; if slung low down, too far forward on the withers, or too far backwards on the loins, the production of galls will be the result, and both the progress of the animal and his free respiration are interfered with; the lower line of the load should be even with the shoulders. The saddle should not be carelessly put on the animal's back, but carefully

adjusted, the loads being securely and tightly fastened so that these cannot work away.* If the saddle has to be shifted forward or backward on the march it should be lifted, and not dragged over the animal's back, a frequent source of sores; if the loads get loose they should not be shoved up or down or backwards and forwards, but the whole should be removed and carefully re-packed. Nothing demands greater care with pack animals than careful loading, even balancing of the two loads and prevention of all swaying. The animals should not be kept harnessed or loaded for long periods before actually moving off: this is of great importance with pack animals, as standing about for hours with a load on will only exhaust their strength. In despatching daily convoys of stores, the loads should, if possible, be arranged the night before, fatigue parties or labourers being told off to load; thus the animals would not be loaded longer than it is actually necessary.

The same equipment should be daily used for each pack animal. The professional packers of the United States are very particular on this essential point. Their habit is to mark with paint their aparejos in successive numbers, and to mark on the corona, or saddle-cloth, in large figures, the number of the aparejo it belongs to. The same number is cut in the halter of the mule, on the strap which goes under the jaw, and again in the hair on the left side of the animal's neck. The halter with them is permanently fixed on the mule. Thus each animal is always saddled with the aparejo which has been carefully adjusted to his back, and there is no liability to make mistakes, even when saddling at night.

Oxen cannot stand a combination of wet and cold weather. In wet weather they are very liable to sore necks as the secretion from the skin, which to some extent keeps the yoke lubricated in dry weather, is washed away by the rain; the skin is then more liable to abrasion and the friction from the yoke soon produces a sore neck. The part of the yoke bearing on the neck should, in rainy weather, be well greased or oiled every hour whilst the animal is travelling; a supply of grease or oil should be kept handy for the purpose. McDougall's sheep dip is an effective remedy against ticks, which often trouble oxen when in low condition.

The officers and non-commissioned officers should pay particular attention to the line of march; carriers, pack animals, and wagons should move in an uninterrupted stream with proper intervals, but no gaps, conforming to the rule of the road. In a mixed convoy of pack-animals and carriages, the first should always be placed in front, as the carriages often cut up the roads. The drivers should never be permitted to ride on the loaded animals, and no one should be accommodated on the wagon seats but the persons duly authorized to do so. Tarpaulins in wet weather are to cover the loads and not to be used as a covering for the person of the driver. The senior should always march in rear of his charge, leaving the lead to be taken by the next in seniority. Whoever leads should maintain an even pace, the greater the length of the column, the slower should be the pace at the head. Without this precaution, which is of great moment, the middle, and above all the end of the column, will experience sudden checks and alterations of pace, which, when frequently repeated, will greatly distress the animals. At every halt (one should take place every hour), and above all after the first, the animals should be re-girthed and have their feet examined; the cart props should be lowered always on temporary halts. Due care should be taken that carriers or animals are neither overweighted or hurried on the march,

* Drivers, as a rule, tie the loads with ropes drawn so tight that these cut through everything but wood or leather.

as this will most likely seriously affect their carrying powers for the future. It should be borne in mind that, while under excitement, and urged by appeals of a higher nature, men can be got to double their exertions, this power does not extend to animals.

The length of the day's march should not be fixed solely with regard to distance, its difficulty should also be considered; where difficult and distressing roads are to be passed over, the length of the march should be proportionately reduced.

Parking wagons and formations in case of attack should be constantly practised to habituate every individual with this manœuvre. This is the only way to insure rapidity and order when the occasion eventually arises for assuming these formations.

Officers in command of a convoy crossing a bridge or passing through a defile, town, causeway, &c., should never halt their charges until these places have been cleared by the whole convoy. On arrival at a river or stream, the leader of a division of pack animals should himself halt and prevent any of the animals being allowed to drink, as the march of an entire column will be delayed by even a few animals being permitted to stop for that purpose. If it is thought proper to water the whole of the animals a mile or so before reaching camp, and the opportunity occurs, orders to that purpose should be given.

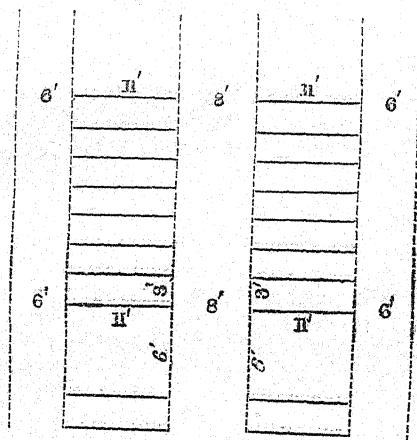
On a convoy being overtaken by the night, it should not be halted in column of route on the road, but should be formed up in some field close by, and be properly parked. The roads should be kept clear, and a convoy making a long halt on a road cannot but seriously impede the circulation.

During the progress of an engagement the drivers should remain with their divisions, ready at a moment's notice to mount and move to the front or rear. Greater attention and regularity is necessary when the transport train comes up after a battle on account of the confusion always to be found in rear of a great battle-field.

Officers of divisions should hold their subordinates responsible for the efficiency and good behaviour of their respective squads, and should ascertain by frequent inspections that the articles of equipment and gear are in serviceable order, and that all repairs are quickly and carefully executed. Each driver should be held responsible for every article in his charge; a small balance of his weekly pay might be kept in hand and paid at the end of each month, if all the articles in his charge are forthcoming.

Everything conducive to the health and comfort of the men and animals should be attended to. Men belonging to the same village or districts should be kept as much as possible together, for they will thus work in better spirits, and help each other in every way. If no tents are used the officers should see that the men erect proper shelter for themselves, and where there is abundance of materials and the inclemency of the weather demands it, temporary stables should be erected for the animals. Sheds 30 feet wide will accommodate two rows of animals; horses require standing room 9 feet long by 5 feet wide, other animals somewhat less. If the animals are to be be picketed in the open, high and level ground should be selected to encamp on, the animals facing away from the wind, and standing even, neither inclined up or down hill. A double rope running from the ring of the head stall to two pegs in front, and a heel rope behind is the most secure way for picketing horses. Small batches may be picketed in a ring fastened to one peg, in which case heel ropes are indispensable. Horses, mules, ponies, and bullocks are better picketed in parallel rows, each two rows to face inwards with a space left between the heads of the animals for the gear and for officers or others moving about superin-

tending the grooming, feeding, &c. On this plan two rows of animals will demand a depth of 30 feet; between each two rows of heel pegs should be allowed a space of 6 feet. Passages 6 feet wide should be provided after every 30 animals; each block of 60 animals will thus require a piece of ground 30×10 yards.



Camels are best arranged in circles facing inwards; warmth and mutual protection from cold winds will be thus obtained. Each circle should contain 50 camels, demanding a space of 22 yards square. A circle with a radius of 11 paces will afford ample room for 50 camels, their food, gear, and attendants.

Bullocks in India are usually picketed 50 together, for which purpose a line rope double of hemp, 105 feet long, is issued for every fifty animals. This rope has fastenings of hemp for the bullocks' necks extending along both sides, 4 feet apart. In staging operations, brushes, currycombs, tethering gear, &c., should form part of the camp equipment of each station, and should be kept there and not be carried by the animals going from one station to another.

Transport animals doing continuous heavy work and subject to a deal of exposure require to be kept warm at night, and to be protected from cold winds and sudden chills; if no sheds are at hand, and the animals are picketed in the open, some description of blanket or clothing should be provided for them, to be kept on their backs throughout the night and taken off after sunrise. Keeping the blanket dry is a matter of great consequence, there is no necessity in putting it on in slight showers, but during heavy and continuous rain it should be kept on. As soon as the rain has ceased the blanket or covering should be quickly dried. Should the rain have penetrated through, the blankets should be removed, the animal being wiped with straw and gently exercised to restore the circulation of the blood. When on the approach of night the blanket cannot be dried it should be taken off; as soon as the rain is over the animal should be wiped over for five to ten minutes then blanketed. For camels, jhools are used; these should be long enough to touch the ground when the animal is sitting, and thus protect the stomach from the wind. If, for warmth, camel saddles are allowed to remain on all night, it should first be ascertained that they do not cover a sore. The objection against allowing them to remain is that constant pressure is very likely to produce one. Some sort of bedding should likewise be con-

trived to keep the animal's bodies from actual contact with the cold ground.

The sooner the animals are fed and groomed after arrival in camp the better; if there are not sufficient men to unload the wagons these should be parked and the animals taken out, the unloading of the stores can take place afterwards, if necessary. The lines should be pitched as close as possible to the magazines, dépôts, &c., to reduce as much as possible the extra work in going and coming from the lines to load and unload. Saddles should not be removed until the expiration of an hour after arrival in camp, so that the animals may get gradually cool.

An immediate report of any falling off in the quantity or quality of the rations and forage should be made. Officers in charge of divisions should inspect both rations and forage daily and see that each driver and animal gets his full authorised allowance. The forage should be varied as much as possible. On account of the small size of their stomachs horses and mules should be fed often, with small quantities at the time.* When in the lines they should be fed regularly four times a day, viz., in the early morning, after mid-day stables, again after evening stables, and the last thing at night. On the march the hours for feeding must vary according to circumstances. With oxen, the distance to be got over on the march should be divided into two parts, the first should be accomplished, starting early after the animals have been watered and slightly fed: a halt of a few hours should be made in the middle of the day and the animals fed, after which the march should be resumed, the animals after arrival in camp being again watered and fed for the night. Oxen should graze at least for six hours a day where the grass is good and plentiful, and for longer where it is not; if grazed for an hour before setting off they would chew the cud in travelling.† Camels at rest should be lightly fed in the morning, but when working should receive their entire ration at once when the day's work is completed. For camels, to be nutritious, barley should be bruised.‡ Captain Yaldwin recommends the following scale of forage: 1st, 20 to 25 seers of missa bhoosa daily for each camel, no grain. 2nd, 6 seers missa bhoosa, 6 white or straw bhoosa, 2 seers of crushed and soaked grain or mote. 3rd, 8 to 10 seers white or straw bhoosa, 3 seers crushed and soaked grain or mote. A pound of ata mixed with ghee is worth twice the quantity of grain in nourishing powers. Flour, old ghoor, and ghee mixed together are very nourishing. Four pounds of barley flour mixed with the fat of the doomba sheep, and made into balls, is more nourishing than 8 lbs. of barley. In the late Afghan campaign the scale of rations for camels on the Khyber line was 10 seers of bhoosa, kirbie or grass, and 3, 2, 1½, and 1 seers of barley, according as the animals were on command, fatigue duty, in cantonment, or at graze. On the Bolan line 4 lbs. of either gram or jowaree, as procurable, were allowed with grazing, also 8 lbs. of kirbie grass, bhoosa or wheat straw, with grazing, 20 lbs. without.

To work either on a full or empty stomach is likely to prove injurious; the animals should be lightly fed the first thing in the morning; all should eat their corn out of the nosebags and not off the ground, as a good deal of grain will be wasted if proper attention is not paid to this. Each animal on the march should carry one full

* A mule will take about 20 minutes to eat the ordinary ration.

† On the Bolan line of communications the forage allowed for each bullock was kirbie, grass, bhoosa, or wheat-straw 20 lbs., cotton seed and oil cake mixed, gram or jowaree 4 lbs., if any of these were procurable.

‡ Owing to the great dryness of barley the horse has great difficulty in masticating it, swallows the greatest part whole, and does not digest it, hence gets less nourishment from it.

day's allowance of grain and forage; if there are spare animals they should be utilized to carry this day's food for a number of animals.

Protection for the animals whilst out grazing is of great importance. Sentries are necessary for this purpose, picquets being thrown out all round the grazing ground, the animals if necessary being hobbled; the picquets must patrol and examine the ground at a distance before the animals are allowed out to graze, and should not return to camp until the animals are driven in. No one should take animals beyond the picquets; any person doing so should be severely punished.

The animals should be watered in the early morning, and again in the afternoon (the middle of the day is the best time for watering, but at work this will be impracticable) getting good clean water (not fouled by decomposing animal or vegetable matter) as much as they can take. If an animal does not feel inclined to drink, a handful of freshly plucked grass put into a bucket of water may often tempt him to do so. Camels require as careful watering as other animals; unless a large supply of water has been administered they require to be watered daily. Before starting for a march, however, little water should be given; and after feeding on arrival in camp two hours or more should be allowed to elapse before the animals are watered.* Coming in very warm from work, no water should be given until the animal is thoroughly cool, and then he should not be allowed to drink too freely. If possible to water a mile or so before reaching camp, it will be better to do so than to wait until after grooming, or when the body has cooled. Near the lines, half barrels, if procurable, should be arranged for convenience of watering; it is often necessary to change the water in them once a day.

Animals should be groomed before starting, and after arrival in camp. This grooming need not be excessive, but such as will keep the animals in good health, for if overdone, the skin will be rendered sensitive to all the changes of temperature. "Animals of all kinds, in a wild and natural state, have a way of keeping themselves clean. . . . But when man deprives them of the privileges by tying them up and domesticating them, he must assist them in the most natural way to keep themselves clean."—(Riley). Grooming is very refreshing for animals after a hard day's work. As soon as the animals have been unloaded, or unhooked, if they have not to go out to graze, they should be groomed for about half-an-hour, otherwise the grooming should be put off until their return to the lines from grazing. The mane, tail and heels should receive particular attention. The legs require great care, if wet they should be dried and hand-rubbed. Legs and heels should not be washed, the mud should be allowed to dry on them, being afterwards removed by wisp and brush. Dock, eyes, and nostrils should be sponged or wiped with a wet cloth, especially after a dusty march. Animals at rest should be exercised for the space of an hour at least daily.

After arrival in camp Transport Officers and their subordinates should make a careful inspection of the animals, carriages, and harness, attending at once to all that can be done to repair the effects of the march. With pack transport, as before recommended, a good experienced packer should be detailed for each division to look solely after the

* The cause of watering immediately after feeding, being injurious is as follows:—Active digestion is at this time going on, and the gastric juice is diluted by the water, and its solvent power is impaired. 2nd, the water in its passage through the stomach to the cæcum, or water stomach, carries with it into the intestines partially undigested food unfit for assimilation; this food acts as an irritant, and gives rise to cases of spasmodic and flatulent colic, indigestion, and possibly inflammation.—T. P. Gudin.

proper adjustment of the loads ; this precaution will save many animals becoming galled.

In wet weather the utmost attention should be paid to the gear not being left in the rain, and to dry everything as soon as possible after the rain has ceased. Wet padding gives sore backs sooner than anything else, hence every attention should be paid to its being thoroughly dried before being again used.

No lines should be left at night without a stable picquet with sufficient flying sentries to look after the animals, and the security of public property. A small party also should watch over the property in the lines when the division is out. All stable picquets should be provided with lanterns.

A roll of the men should be called the first thing in the morning and the last thing at night.

As soon as practicable after the formation of a camp, latrines and refuse pits should be dug, and every attention paid to such like sanitary measures. The men should be made to parade often to ascertain that they maintain themselves clean ; this inspection should at times be conducted by medical officers to detect disease. Animals that die in camp or on the line of march should be removed some distance from camp or from the main road, and, if possible, buried or burnt. The skins of dead animals may come in useful for a variety of purposes, and should be removed and retained. These can be roughly cured by being stretched and pegged down to the ground, hair side down ; wood cinders well rubbed into the skin will absorb all the fat and greasy matter, which can afterwards be scraped off with a knife.

The officers must take great care that it is thoroughly explained to the men that looting, pillaging, wanton destruction of property, &c., by camp followers cannot be tolerated. Any complaints against the men on this score should be immediately investigated, and, if found correct, the offenders should be delivered over to the Provost Marshal for punishment.

Steps should be taken against the men getting access to intoxicating liquors which will be sure to affect the efficiency of the transport service. The liquor should be either confiscated and destroyed, or men should be encamped as far as possible from public houses, which should be put out of bounds.

Rest after hard work is necessary both for men and animals ; strict silence must therefore be maintained in the lines during the night. The hours between which no noise of any kind is to be permitted can only be fixed according to circumstances.

Officers should make themselves acquainted with the resources of the country in means of transport so as to be able to supply any deficiency when necessary, or increase the carrying powers of their divisions when the necessities of the army may demand it. They should become personally acquainted with men in their locality whose wealth or influence would design them as the most likely individuals to assist in collecting a large amount of transport when needed. If means for feeding their men and animals are to be found in the vicinity of their stations, the information should be communicated to the Commissariat officers with a view to a proper contract being entered into with the people of the place, this will ensure one market price in the purchases throughout. Every pound weight procured round the stations will assist the Commissariat Department in rear. At the principal stations a reserve of forage will have to be stored, the number of days' provision depending upon instructions issued from time to time. The stores of grain and forage should be established in some high and well drained locality close and of easy access to the lines, the goods resting on platforms raised a foot above the level of the ground

All Transport officers should keep a brief journal of the daily work performed, with any remarks and notes from their personal observations; these journals will be of great assistance in compiling at the conclusion of the war a summary of the labours and expense of the corps, and in collecting information which may come in useful in future expeditions. They should report daily to their immediate transport superior how their divisions or sections have been occupied, the animals available for duty, or sick, the state of their *matériel*, and any particulars they may deem desirable the Director should be made acquainted with.

Transport officers should strictly confine themselves to transport duties as long as they are attached to this branch of the service, and independent of their army rank, should not assume command over any troops in any position whatever. It should be also clearly borne in mind that, setting aside the special duties each portion of the transport of an army is told off for, each officer and man is liable for any other duty that the General Commanding may from time to time think fit to call upon him to perform.

It has already been noticed in Chapter II how very desirable it is that the soldier should have an opportunity of acquiring some knowledge in transport work, and should become accustomed especially in the loading of wagons and pack animals. The report of the Kabul Committee on Equipment contains a memorandum on this subject, and as it may form a guide in imparting this necessary instruction to the soldier, it is considered advisable to insert it here at length. This instruction can be imparted on the mobilization and formation of a force for field service, or in those halts which often occur before the entire force is put in motion and is advanced into the enemy's country.

“MEMORANDUM, DATED KABUL, 8TH FEBRUARY, 1880.

“*Packing and Loading—Tuition of Soldiers.*

“180. For all regiments two men per company should be told off as transport assistants. The number employed up to two per company to be regulated by commanding officers, proportionately to the number of animals in regimental charge.

“181. These men on the march of the regiment should form part and be included in the baggage guard, thus no strength is lost, while the gain in having trained packers and loaders, in addition to fighting men, is manifest.

“182. There are five descriptions of loads which collectively form the equipment and comfort of the soldier, and all of which should follow close behind him. These loads he himself has to pack and load, and he should be taught, through the regimental Transport Officer and his assistants, how to do this quickly and well. The tuition and training therefore of the regimental Transport Officer and his assistants has first to be done.

“183. The five loads above mentioned are:—

1. Ammunition.
2. Entrenching Tools.
3. Kits.
4. Tents.
5. Cooking pots.

“These on the march of the regiment should be loaded on fast travelling animals and follow as close as possible.

“184. The regimental Transport Officer and assistants should parade daily for an hour, each regiment bringing five loads as above;

regiments of one brigade parading together when a Transport or other competent officer should be sent to supervise the instruction. The loads of one kind should then be brought to the front, say the ammunition load of each regiment; the faults in loading pointed out and rectified.

"When all are correct, these should be unladen entirely and reloaded, each by four other men, and so on till the transport assistants have each taken part in loading it correctly; then a load of another kind brought up, and the same process gone through.

"185. It is very marked how four men, thus practised daily, learn to load and pack properly and rapidly. When once the regimental Transport Officer and his assistants can load and pack properly, and can recognize a faulty load and put it right, then training on a larger scale should be put in practice.

"186. A company from each regiment of a brigade should then parade. A systematic plan should be adopted in this case as in the first. If a company of eighty men paraded, sixteen men should be put on to each of the five loads, and changed from one load to another till they know something of each; the next day the same company should parade again, with all their baggage loaded and brought on to the ground. When all faults in loading are remedied, these companies should march off, and test their loading and packing by ascending and descending adjacent hills.

"187. Other companies should then go through the same short course, and if time admits it should be repeated by each company in succession, and be a daily practice for at least one company per regiment, till the men are thoroughly practised.

"188. The soldier no doubt finds it difficult at first to load and pack well owing to the great diversity of saddles and animals in use, but the main principles remain the same whatever saddle is used, or whatever animal, viz., that the loads should be as compressed as possible and placed as high on the animal as possible without destroying the balance.

"189. The general transport can greatly assist good packing and loading by issuing certain articles of fittings where any bad government saddles are used: in these cases "chats" are necessary for ammunition, kits, and tents, and a certain number must be issued per company according to the probability of their receiving hired mules or animals with other than Government saddles.

"190. Every load of every kind should have a broad surcingle going right over the load and passing under the animals stomach so securing the whole. This is one of the mainstays of a load in a hilly country, and no load should be without it. They are being issued to Regiments in this division for every load."

Treatment of Sick Animals.

Though all transport officers should know something of the treatment of sick animals, still all cases of sickness should be handed over to the Veterinary Surgeons and farriers, for doctoring can never be so successfully performed as when undertaken by people, who either through study or practice have acquired a certain amount of experience, besides which the officers' time is needed for other duties. A medicine chest with detailed instructions for the treatment of sick animals should be, however, provided for each section of transport devoid of the professional assistance of a Veterinary Surgeon. Wounds produced from bad pack-saddles, and bad loading, will form a large portion of the cases in the sick lines, incapacitating large numbers of animals for work, and rendering them for a time useless; this has to be carefully guarded

against. Without entering into the veterinary part of the question, exception must be made to two cases of frequent occurrence, viz., colic and galls, which not only officers, but their subordinates should thoroughly understand how to cure.

The following extract from a small pamphlet drawn up by Veterinary Surgeon B. L. Glover, Royal Artillery, and issued during the Zulu war, explains in a few words the best course to pursue in each case:—

“*Colic*.—On the occurrence of an attack of colic, the animal should be walked about at a brisk pace, and his belly well rubbed at intervals. These simple measures will often cure a slight case. If no improvement, however, takes place in half-an-hour, a colic drink must be administered, and repeated, if necessary, in a couple of hours' time. An injection of about three pints of warm water should be given, a brandy or beer bottle, in the absence of an injection pipe, being used for the purpose of giving it. In severe and long continued cases, the abdomen must be fomented with water as hot as the animal will bear. As colic very often occurs from the presence of some indigestible food in the bowels, the sooner they can be made to act the better. With this view, therefore, the injection may be repeated every hour till two or three have been administered. On many occasions an animal will show symptoms of colic which will pass off as soon as he stales; every encouragement should therefore be given for this purpose, and the act of throwing some grass or bedding under the belly, will often excite urination. Care should be observed in feeding for a few days after an attack of colic. If possible the food should consist of bran and oat-hay, little or no mealies* being given, and if the ‘droppings’ are at all unhealthy, a dose of opening medicine will be necessary.

“*Galls*.—Saddle and harness galls, when taken in time and treated properly, rarely give much trouble. The back and places touched by the harness should be examined every day, and the slightest sign of tenderness or abrasion be promptly attended to. Hot fomentations or poultices may be required, and if there is an actual break in the skin, healing lotion must be applied daily. Free exit must be given for all discharge, and the formation of hard scabs prevented. In hot weather, the application of moisture, and protection from flies is of great importance in healing all kinds of wounds, and for the purpose a wet cloth should be kept over the wound during the day.”

When exposed to cold and wet, if a proper system of feeding and clothing is established, the sickness will not be great. Mange† will be likely to appear amongst debilitated transport animals; it spreads with great rapidity if remedies are not at hand, and there is no veterinary supervision. Careful inspection is necessary to detect glanders, which may be unsuspected by the attendants.

Mr. Glover has a few remarks on medicines, and gives a list of valuable prescriptions which, as likely to be useful to officers when deprived of veterinary aid, we take the liberty of borrowing from him:—

“*Medicines*.—The following prescriptions are given in the form of a drink or powder, for the reason that they are more easily administered this way. A drench acts quicker than a ball, which is another consideration in its favour. The doses are intended for a medium sized horse, a small pony or mule should therefore only get half the quantities. The different drenches, etc., are arranged according to their value, the first one under each heading being the most recommended:—

* “This is a most dangerous grain to use as food in large quantities, unless it has been steeped.”—(Gillmore.)

† At all transport depôts or stations a boiler should be provided to dip the clothing of mangy animals into hot water. Lice can be destroyed by tobacco water.

"Healing Lotions.

"1. Sulphate of zinc, $\frac{1}{2}$ -ounce; acetate of lead, $\frac{1}{2}$ -ounce; water, $1\frac{1}{2}$ pint; to be well shaken up before being applied.

"2. Common carbohc acid, $\frac{1}{2}$ -ounce; spirits of turpentine, 1 ounce; water, $1\frac{1}{2}$ pints.

"3. Common salt, 1 ounce; rum or gin, 2 ounces; water, 1 pint.

"Colic Drinks.

"1. Tincture of opium, 2 ounces; spirits of turpentine, 2 ounces; warm water, 1 pint.

"2. Chlorodine, 1 ounce; spirit of turpentine, 2 ounces; warm water, 1 pint.

"3. Gin, half a bottle; ginger, 2 drams; black pepper, $\frac{1}{2}$ -ounce; warm water, 1 pint.

"Anti-purging Medicine.

"1. Alum, 2 drams; tincture of opium, 1 ounce; ginger, 2 drams; warm water, 1 pint.

"2. Ginger, 2 drams; alum, 2 drams; warm water, 1 pint. "

"3. Powdered alum, $\frac{1}{2}$ -ounce; to be given mixed up in the food.

"Cough Drinks and Powders.

"1. Camphor, 1 dram; nitre, 2 drams; powdered opium, 1 dram; water, 1 pint.

"2. Powdered nitre, 3 drams; tartar emetic, $\frac{1}{2}$ -dram; grind fine and mix up in a mash.

"3. Powdered nitre, 4 drams; grind fine, and mix up in a mash.

"Turpentine Liniment.

"Spirits of turpentine, 1 ounce; liquid ammonia, 1 ounce; linseed, or olive oil, 1 ounce; mix well and rub on with friction.

"Diuretic Medicine.

"1. Nitre, 2 drams; camphor, 1 dram; sweet spirit of nitre, 1 ounce; water, 1 pint.

"2. Powdered nitre, 3 drams; powdered resin, 2 drams; given mixed up in a mash.

"3. Nitre, 4 drams; grind fine, and give mixed up in a mash.

"Purgative Medicines.

"1. Aloes, 5 drams; ginger, 2 drams; gentian, 2 drams; warm water, 1 pint.

"2 Linseed oil, 1 pint; aloes, 3 drams; ginger, 2 drams.

"Fever drinks.

"1. Nitre, 3 drams; camphor, 1 dram; sweet spirits of nitre, $\frac{1}{2}$ -ounce; water, 1 pint.

"2. Nitre, 3 drams; tincture of opium, $\frac{1}{2}$ -ounce; camphor, 1 dram; water, 1 pint.

"3. Nitre, 4 drams; dissolved in water, and given as a usual drink.

"The following may be found useful in the absence of proper weights and measures:—

1 Sovereign	..	weighs about 2	drams.
1 Half-crown	..	3½	"
1 Two-shilling piece	"	3	"
1 Shilling..	..	1½	"
1 Threepenny piece	"	⅓	"
1 Table-spoon	..	measures 1	ounce.
1 Desert-spoon	..	½	"
1 Tea-spoon	..	¼	"

The following is Mr. Riley's treatment for mules affected by colic:—
 "Take some common soap, make a strong suds, and drench the mule with it. I have found in every case when I used it that the mule got well. It is the Alkali of the soap that neutralizes the gases. There is another good receipt, and it is generally to be found in camp. Take two ounces of saleratus,* put it into a pint of water, shake well and drench with the same."

In speaking of camels it has been said that little is known with regard to the proper treatment of these animals; and as there will be greater difficulty in getting experienced and well informed men to undertake the cure of the sick ones, it may not be out of place to give some prescriptions which have been found to answer by officers who have had experience of these animals on service. Veterinary Surgeon Steel, 16th Lancers, found pneumonia and dysentery the principal diseases camels suffered from during the first phase of the second Afghan war. He recommends the following prescriptions taken from a publication on the diseases of camels:—

"In pneumonia"—

Henbane (Hyosagamus)	..	6	tolas†
Dhatura seed	.. ..	1	"
Turmeric	.. ..	24	"
Mustard seed	.. ..	24	"

"Make into eighteen balls, and give one, two, or three times daily.

"The appetite may be tempted by offering a variety of food frequently, and plain gram is often particularly relished.

"In 'dysentery' a quart of castor oil ought to be given, and repeated once, or oftener, according to the appearance of the evacuations, continuing it when these are slimy. If the purging is not checked, take—

Opium	.. ..	1	tola.
Hemp resin (Bang)	.. ..	4	"
Turmeric	.. ..	24	"

"Divide into eight doses, and give one every eight hours, until the purging diminishes. I cannot speak from experience of the efficacy of

* Saleratus is a carbonate of potash containing more carbonic acid than pearlash; it is used in cookery.

- † 1 dhan or grain of rice = .625 grain.
 3 dhans = 1 ruttī = 1.875 grains.
 8 ruttis = 1 másha = 15 grains.
 12 máshas = 1 tola or rupee weight = 180 grains.
 5 tolas = 1 chittack = 900 grains.
 16 chittacks = 1 pukka seer = 2.0571 lbs. Avoir.
 40 pukka seers = 1 Bengal maund = 82.2857 lbs.
 39 rupees are practically equal to 1 lb. in weight.

these medicines, but should think the prescription for dysentery the most promising; possibly alum, four to eight tolas twice daily, might be of service."

According to Captain Yaldwin, the native Indian remedy for "pneumonia," is kala ziree, lassan, metee, salt, given dry, by throwing it down the animal's throat in the morning; and for "dysentery," sarson ka tel, crushed huldee, ata, mixed up together, and made into balls. The same authority gives as the usual treatment for "itch," rubbing into the skin gundhak, sarson ka tel, or tara meera tel, chok; for "eating away of the nose," bilawa, akh leaves, tara meree tel, tootie, applied twice a day.

Colonel J. J. Boswell, 2nd Sikh Infantry, recommends the following treatment for diseases most common to camels:—

"*Malli or badi*.—Symptoms, refusing to eat. *Cure*.—Quarter seer jiri (coriander seed) every third day for 21 days, making about $2\frac{1}{2}$ seers. Should jiri not be procurable, give same quantity of either red or black pepper, or a native medicine called 'kour'.

"2. *Cough*.—This is the usual symptom of inflammation of the lungs. Take $\frac{1}{4}$ seer poppy seed, $\frac{1}{4}$ seer goor, 1 seer water, boil together till goor is dissolved, divide into four portions, and give one every evening. See that chest is wrapped up warmly.

"3. *Gripes and distended belly*.—2 chittacks soap, country, 2 chittacks ajwain (caraway seeds), 1 seer boiling water, allow to cool; when milk-warm pour down the throat (this is a mild purgative).

"4. *Bleeding nose*.—Camels frequently suffer from this; $\frac{1}{4}$ seer ghi, $\frac{1}{4}$ seer chini (sugar), mix, divide into four portions, give one every day.

"5. *Poison*.—In the Quetta and Peshin (also in Kadanai valley) valleys there is a plant (I have not seen it, but believe it to be a species of *Iris*, or lily) which frequently proves fatal to camels of the Punjab; the camel of the country will not touch it. Administer as soon as possible $\frac{1}{4}$ seer goor, $\frac{1}{4}$ seer red pepper, 1 seer water, boil altogether, and when milk-warm give in one dose.

"6. *Chimukh*.—Symptoms, the camel sprawls on the ground; 1 seer majit (dye), 1 seer sweet oil (til), pound together, divide into four doses, and give one every morning. On fourth day, if not relieved, give one chittack indigo pounded up (dry).

"7. *Stroke of wind*.—Wrap animal well up in jhools, and give 1 seer sweet oil, 1 seer chini, give a quarter each day for four days."

"In May or end of July, each camel should have three seers of either taramira, or sirson oil, administered; this acts as a mild purgative, and keeps the animal in condition. It is given thus:—Take $\frac{1}{4}$ seer oil, and same quantity of milk, or buttermilk, mix, and give a dose every second evening. One seer of same oil is usually allowed to apply externally; it is a preventive of mange. Rub $\frac{1}{2}$ a seer on one day, and remainder the third day. After the oil has been administered internally, give the following as a wind up:—Soak 2 chittacks alum (phitkari) in 1 seer water for 24 hours, pour down the animal's throat."

In the winter of 1879, a large number of camels perished in Afghanistan from dysentery, produced by cold, want of clothing, and by bad and insufficient supply of suitable fodder. The following treatment has been recommended for this disease:—Opium and catechu, 2 to 3 drams night and morning, with doses of 6 to 8 ounces of rum diluted with water, warm clothing, shelter and green leaves in place of bhoosa and barley. Doses of ghee are useful in clearing the bowels.

Large numbers of camels require to be separated into small parties, the cleanliness of their lines demands great care, and a supply of green food should be procured by all possible means.

Baggage-Masters.

Intimately connected with the transport of an army are the officers detailed as Baggage-masters. These officers regulate the assembly and formation of the *impedimenta* previous to their moving off, and are responsible for order, regularity, and discipline during the march. Baggage-masters have nothing to do directly with the efficiency of the transport means, which is the business of the Transport Officers, they only supervise on the march the entire train of their respective army corps, divisions, or brigades, and are specially appointed to guard against the conflicting interests which would be sure to arise if there was no supreme recognized head to take the direction of its component parts.

Baggage-masters should be active, intelligent, and strict in the execution of their duties, without which qualities they would be unable to enforce their authority on the class of men they will have to deal with, often not the most amenable to discipline.

One should be detailed for each brigade, division, and army corps, their army rank increasing with the importance of their charge, and, irrespective of seniority, their orders, as far as it regards the baggage, must be paramount.

The orders for the march will contain information regarding the place of rendezvous for the baggage, the order of formation, the strength and composition of the baggage guards, the hour of starting, the road to be followed, the destination of the baggage, and any other dispositions that, according to circumstances, may be necessary to detail. In a division, the brigade Baggage-masters should take their orders from the divisional Baggage-master; in an army corps the divisional Baggage-masters should in the same way be under the direction of the Baggage Master of the army corps. Each Baggage-master should have one or more steady mounted non-commissioned officers to assist him in his duties.

The military police are generally placed on the line of march with the baggage; any men committing themselves or disobeying the orders of the Baggage-master should be at once handed over to their custody. The military police, however, are with the baggage, only to assist in keeping order, and do in no way constitute part of its escort.

The Baggage-masters have the direction on the march of all the wagons, carts, and pack-animals, which do not find a place with the fighting portion of the column. The baggage should be always formed up by brigades on their respective assembly grounds, and may be moved to the divisional ground before joining the column; however, it will be preferable to dispense with this, and to move it at once from its own brigade ground to the initial point of march, each Baggage-master having ascertained the time necessary to proceed thereto, so as to file in his baggage without loss of time.

The usual order of march for the *impedimenta* of each division is as follows:—

- Baggage of Head-quarters of the Division.
- " " Divisional Cavalry Regiment.
- " " Head-quarters, 1st Infantry Brigade.
- " " 1st Infantry Brigade (in the same consecutive order as the regiments occupy in the column).
- " " Head-quarters, 2nd Infantry Brigade.
- " " 2nd Infantry Brigade (in the same consecutive order as the regiments occupy in the column).

Provision columns.

Stores and *matériel*.

Field hospitals.

One or more companies of infantry, and a detachment of military police close up the whole.

On the march the Baggage-masters should see that all the carriages and pack-animals keep their assigned place, that the drivers and men of the escort do not quit the column, and do not molest the inhabitants; that whoever leads maintains a steady pace, that no gaps are formed, that no unauthorized animals or carriages join the column, and that all break-downs receive prompt assistance; in all of which duties they must be assisted by the Transport officers. In short halts the baggage should remain in column of route, all drivers dismounting; in those of longer duration it may be parked to allow of the animals being unhooked and rested.

In crossing a bridge or defile, or in passing through a village or town, the Baggage-masters should place sufficient guards for the maintenance of good order, and the prevention of unnecessary halts.

On approaching the camp or bivouac, it will be well to make a short halt to get the baggage in perfect order, and correct any irregularities, after which, according to the instructions received, the baggage will be either parked, or the several portions will be directed to rejoin their respective head-quarters, regiments, or departments.

At the conclusion of the march, the Baggage-masters should report to their respective Staff Officers the arrival of the baggage at its destination, stating any irregularities which have been committed, any arrests made, and reporting any other occurrences which may have come under their observation.

Convoys, Parking of Wagons, and Formations in case of Attack.

The conduct of convoys, and the formations to assume in case of attack, require to be carefully understood by all officers; it seems, therefore, desirable, whilst treating on the general subject of transport, to allude in a special manner to these points.

As it will take on an average about half-an-hour for fifty carts to get into movement, in a large convoy animals should be only harnessed and put to in succession. Moving in column of route, wagons and carts follow each other, with an interval of four yards between each. The pace of all transport is the walk; the strictest attention should be paid to conform to the rule of the road, and, except in cases when it is of great moment to shorten the length of the column, and the breadth of the road admits of it, no two carts should ever move abreast. As a rule it is of great importance to guard against encumbering the roads, and this double formation can only be assumed where the road is exceptionally broad, and the absence of defiles permits its being retained for a long time.

Counter orders have a more marked effect on convoys and baggage trains than on troops, and should be as much as possible avoided. At times fresh information, and a sudden change in the actual circumstances, render counter orders unavoidable; if the commander of a convoy is prepared for this and acts with decision, there will be less liability to confusion.

A convoy, or a division of the transport train is parked, when the wagons or carts are all ranged in an orderly mass, generally in successive parallel lines in accordance with some established plan, the animals being picketed in the vicinity of the carriages they are intended to draw. The most convenient manner of parking is to form up the lines of wagons at such a distance from one another as will permit of the animals being picketed in the intermediate spaces. In this way the animals can be harnessed, and put to in the shortest time. Where

wagons are drawn by a large team of animals, as, for example, in the Cape Colony, or in Natal, as the interval of a span of oxen between one line of wagons and the next would demand a very considerable amount of room, a more compact formation should be adopted.

The system in general use with the Mexicans of forming a temporary corral with their carriages will be often found convenient. They arrange the carriages in a large circle, the space between the wagons being closed by ropes stretched from one wagon to another, the animals are kept in the interior, and fed out of light portable mangers. The laagers employed by the colonists in South Africa and by our troops in the Zulu war, to withstand the attacks of the very superior numbers of the enemy, are a somewhat similar arrangement; the carriages being placed close together, the intervening spaces being filled up with pack-saddles, bags, brushwood, etc.

In countries where the people are hostile, it will be always prudent to park a convoy far from inhabited localities; this should always be the rule when a convoy contains ammunition, or other combustible materials. The injunctions against smoking in the proximity of convoys of this kind should be frequently repeated, and strictly enforced.

Convoys moving close in rear of an army, being generally protected by the presence of the army in front, will seldom demand a special escort; a sufficient force to ensure order, and to attend to matters of police, being all that will be required. When they are, however, moving along the line of communications, exposed to an attack from the enemy, or journeying through a disaffected country, they require an escort of sufficient strength, commanded by an officer of ability. Those composed of powder and ammunition require stronger escorts than those of provisions and stores, to keep the enemy further off the convoy during an attack. Convoys, above all, in intricate and densely wooded countries, must be well guarded, for a weakly guarded convoy will always be sure to invite attack. Attacks will be made by tribes occupying the country on convoys, in preference to molesting the troops, for, whereas they have nothing to gain but defeat by attacking an orderly body of troops, they have much to expect by the capture of a convoy.

The officer commanding the escort and convoy should be one, any officers marching with it, though of superior rank, should have no authority to interfere with his command. On the eve of departure all that is to form part of the convoy should be assembled, and parked outside the fort, town, or other starting place, and a minute inspection should be made by the officer in charge of everything connected with it. He should ascertain that the animals, wagons, harness, etc., are in good order; that the wagons and carts have been properly loaded, and the animals are well shod; that a certain number of spare poles, wheels, shafts, tools, and other articles to repair damages on the road, and drag ropes to help wagons out of difficulties, have been provided; that no sick drivers or animal are present; if forage has to be carried, that it has been drawn and properly distributed; in short, that everything is in the best possible order.

Where everything the troops have to depend upon for a certain length of time is carried by convoys, it becomes necessary to guard them very jealously; thus in our small wars in a certain sense the troops may be said to be mainly employed as escorts for the convoys, for these can only travel safely as long as they move under the protection of a strong armed escort. Infantry is the proper arm to employ for the protection of convoys, but a party of cavalry should be added to scout, reconnoitre at a distance, and give timely warning of danger to the commander so as to enable him to make preparations for

defence. In the bush, in wooded or broken countries, where cavalry cannot act, infantry is the only arm that can be used, and must then furnish the flanking parties.

Napoleon generally allowed for the escort of a convoy not less than—

2 Infantry soldiers to each carriage.

1 Light cavalry soldier for every eight carriages.

1 Gun for every 120 carriages.

About 250 infantry and 25 cavalry soldiers may be admitted as necessary to protect a convoy composed of from 50 to 60 carriages.

In very hostile districts horses only should be used for draught, bullocks should be reserved for quieter localities, or for those portions of the road where troops in camp or cantonments afford ready means of protection. On special occasions light loads can be put on horses which can trot with the cavalry. The Americans adopted from the Indians the following method for carrying supplies on special occasions when rapidity of movement was much needed: "Two long poles are attached to the saddle, stretching out behind until they reach the ground. On this inclined plane the necessary supplies are strapped; and thus equipped the horses can get over the roughest ground at a fair pace without difficulty." This contrivance is called a *travois* or *trava*, and is used also for the carriage of the sick, as shown in Chapter VII.

When pack-animals and wagons both form part of a convoy, the first should be placed in front, and the empty carriages should be kept separate from the loaded ones. The articles in a convoy should be ranged in the following order—ammunition, treasure, provisions, military stores, officers' baggage, suttlers and merchants' carts. No unauthorized animals or carriages should be permitted on any account to join it. The Americans placed the empty wagons at the head of each convoy, and as they fell in with places containing provisions, these wagons quitted the road to take up a load, afterwards taking their place in the rear.

Great prudence must be exercised to ensure the safety of a convoy; whether anything is to be apprehended from the enemy or not, the possibility of an attack should always be kept in view, every disposition being taken to meet it in the best possible way. It will be wise to take even what may appear superfluous precautions, where the loss of a single wagon may be severely felt by the army. In all cases where noise may point out to the enemy the whereabouts of a convoy, silence should be enjoined, and the drivers should be forbidden to sing, shout, or even to crack their whips.

The precaution of destroying any cover, such as high grass, bushes, etc., close to the line of communications, which would facilitate a surprise, should never be neglected when practicable.

In moving over bad roads a few intelligent men might be pushed forward to examine the state of the road. A small body of pioneers with pack animals carrying tools would be at the head of the convoy: on arriving at a bad part of the road, the men in advance having determined what should be done to repair it, would then set the pioneers to work. Often a few spade-fuls of earth will be enough, and will greatly facilitate the passage of the wagons.

To avoid the constant hurrying of the rear wagons to preserve the regulated distances, and the delays and jamming up at bad places, in preference to moving the carriages in one long continuous string, these should be divided, if circumstances will permit, into small groups, according to the unit of command assigned to superintendents or non-commissioned officers; the slowest walking teams should lead, and each group should be followed by a certain number of spare animals,

ready harnessed, to extricate and help forward any wagon that may get into difficulties. By these means the animals of the last wagon in each group will not be required to move quicker than at a fast walk, and the gaps will occur between groups and not between wagons.

Major Seyfert von Teuneker, who, having had charge of the train of the Saxon Army during the wars that took place between 1805 and 1815, gained a good deal of experience in transport, says:—

“When not in the presence of the enemy, one should avoid to make the carriages close up; on the contrary, it is indispensable to leave a distance of from 8 to 10 paces between a carriage and the one that follows it. Undoubtedly it results from this that the column is lengthened, but this drawback is largely made up for by the following advantages.

“If a carriage is obliged to stop for a moment, those following are not necessarily also obliged to stop; nothing tires the animals more than checks, as it demands afterwards all their strength to get the carriage again into motion.

“In ascending an incline, a halt is necessary from time to time, principally on level spots, to enable the animals to recover their wind and strength; if the carriages move closed up, it is impossible to procure this rest to one set without stopping simultaneously all the convoy on the incline, which is dangerous and often impracticable. It is therefore preferable that the halt should be successive, as each carriage arrives on the level.

“In descending, if the carriages follow each other very close, one cannot be stopped to put on the skidd without risk of the following one running against it or damaging it.

“Thus we notice the heavily laden wagons of commerce marching slowly at a certain distance one from the other. In moving a convoy, we must imitate them. In this way, it is true, one arrives slowly but surely; whereas nothing ruins the animals so much as for one to tread on the heels of the other, and to pass alternately from a halt to a trot under pretext of closing up.

“For these reasons the most heavily laden carriages should move at the head of the convoy, and the lightest behind. Forges and carriages conveying articles for repairs, and spare animals should be divided amongst the various parts of the column.”

Spare articles for immediate repairs should be divided amongst the carriages; some of these latter are often abandoned, whereas with very trifling repairs they might be brought into camp. In rear of the convoy should travel a wagon carrying spare poles, traces, harness, axles, and articles for more considerable repairs.

The superintendents or non-commissioned officers should be all mounted; they thus can more readily assist on arriving at a difficult place to get the carriages over, and can better superintend the movement of the portion of the convoy in their immediate charge. They will also be spared considerable fatigue, and be more fit for work at the conclusion of the march.

Any carriage becoming disabled on the way should be drawn on one side and quickly repaired; after the repairs have been completed, it should take its place in rear of the group or of the convoy. When a disabled wagon cannot be put in a fit state to proceed further, it must be removed to one side to clear the road, and should be replaced by one requisitioned from some village or farm in the neighbourhood, if one can be procured, in default of which the contents should be distributed amongst the lightest loaded of the remaining carriages, the draught animals being distributed amongst the carriages that are most in want of them.

On the appearance of an enemy, greater attention must be paid to the drivers of requisitioned transport, for serving as they often do against their will, they may try in the bustle of an attack to cut the horses' traces and save themselves, leaving the carriages without horses at the very time when the forward motion of the convoy should be, if anything, increased.

A convoy or division of transport may be attacked on the march, in which case certain precautions and formations are necessary to ensure its safety, whilst the escort detailed for its protection, repel the attack and drive back the assailants. Always, on an enemy appearing in sight, a careful examination should be made to ascertain if he is in a state of attacking with forces superior to the strength of the escort. The main points every commander of a convoy has to keep in mind are to conduct the convoy entrusted to his charge safely to its destination, to avoid an engagement with the enemy, if he can, and only to halt and park as a last resource. It should be borne in mind that it takes a long time to park wagons, and generally more than a strong enemy will be inclined to accord; if the enemy, therefore, is not in strength, the march should not be delayed; if, on the other hand, he is in superior numbers, and the march cannot be continued, it may be necessary to adopt a compact formation that will make the convoy stronger, better capable of being defended by the escort, and will even afford shelter to its defenders if driven back.

The ancients in their journeys of invasion through Europe parked their carts in hollow squares, linking them together with iron chains, the spaces between the wheels being filled up with pack-saddles piled one upon another; thus their carts served them both as means of transport and defence. Froissart, in his description of the battle of Crécy, states that Edward III formed his wagons and carts in a large park in rear of his army, in the vicinity of a wood, and within this he placed all the horses: this park had only one entrance. Owing to our troubles in Zululand we have become familiar lately with the word *laager*; but the word, which is only the Dutch for fort, was nothing more or less in reality than parking the convoy, which, though the Boers may have had to do it very frequently in their uneven contests with the owners of the soil, is not only practised in South Africa, but is recommended in many military books as the formation to assume either in case of attack, or where an attack is to be expected. In Sir Charles Napier's organized camel transport in Scinde, in cases of attack, the animals were formed in rings or squares, sitting down with their heads inwards, forming a living parapet from behind which the drivers poured their carbine fire on the assailants and kept them off. The Russians in their expeditions in the Steppes arranged their bivouacs behind wagon-barricades, which were either formed in the shape of a square, the sides of which were proportionate to the number of men to defend them, and contained all the horses and cattle (Fig. 25)* or, if a natural obstacle was at hand, such as a river or ravine, in the shape of a lunette with the open side resting on the obstacle.

To give an idea of a *laager* as formed by the colonists in South Africa for protection either against men or wild animals, we must first examine their wagon. A Cape wagon is of great size, measuring generally about 18 feet in length by 4 feet in breadth, strongly but loosely made, running on four large wheels. The sides are 3 feet high, and above them rises a framework, over which a sail or awning is

* See Article on Turkestan in No. 108, Vol. xxiv, Journal of the Royal United Service Institution, translated from the Russian by Major Clarke, C.M.G., R.A.

drawn to protect the traveller and his goods from heavy dews, rains and sun, for this wagon is often the home of the owner and family for many days. A framework to support pots, kettles, and sundry articles is slung under the body of the wagon, which effectually prevents any one gliding under the body of the same. The wagon has to stand an enormous strain especially going up and down hill, from the terrible jolting to which it is exposed moving over the rough roads of the country, as the frequent heavy tropical rains effectually wash away the soil from the roads, and they, after a time, become staircases of rock. Each wagon is generally drawn by a span of from ten to eighteen oxen. A pair are attached to the pole (*dissel-boom*), and the remainder are yoked to a long hide rope (*trektouw*): no reins are used, but a native precedes the fore-oxen, or leaders of the first wagon, guiding them by means of a bow, the remaining animals following in the track of their companions. A good pair of fore-oxen is necessary; these animals are very sagacious in picking out and keeping the track, and will even pick out an old one of several months before, though left by a single wagon. A wagon of this kind drawn by 16 oxen takes up 32 yards of road, and, allowing for intervals, about 40 yards.

In travelling, at the first streak of dawn the drivers inspan the oxen, and make a start; about 10 o'clock, or earlier if water is reached, a halt is made, the animals are outspanned and allowed to graze while the men cook and feed. The journey is resumed in the afternoon, at the end of which the laager is prepared. After the cattle have grazed for a sufficient time under the eye of a herdsman, they are driven into camp, and secured for the night to the wagon chain.

The laager is a hollow square formed with the wagons ranged in a row, axle to axle, end to end, or in echelon.* Every opening through which an enemy could worm his body being closed by means of brushwood and thorny bushes. Loop-holes are cut in the outer part of the wagon caps for the defenders to fire through, and, to strengthen the defence, a trench is cut outside the laager, the earth from which is piled against, and between the wheels. The horses and oxen are secured inside the laager, in the centre of which is placed the ammunition wagon. With every large Boer commando there is a special laager commandant, whose primary duty is to form the camp. With a large force the laager is surrounded by a wall of sods raised about ten feet from the wagons, and in the intervening space are pitched the men's tents†.

Parking wagons is always a precaution to take when there is a large number of them present in the vicinity of the enemy, where the inhabitants are hostile and the country of such a nature as to favour an attack, and when the force for their protection is small. Parking will give the troops a better chance of directing their attention to the enemy, knowing that the park is pretty safe and ready to afford them an ultimate defence, as a keep in a fortress. Parking should be a standing order, the same as throwing up some description of hasty entrenchment, in every case of a small body moving in a wild, dangerous country, is a precaution to take in the event of being attacked by superior numbers, beyond reach of immediate support.

* In arranging the wagons in echelon the nave of the front wheel of each wagon as it is brought into position jams against the nave of the hind wheel of the wagon in front (see Fig. 26).

† With regard to the formation of laagers, see Major Molyneux's "Notes on Hasty Defences as practised in South Africa." R.U.S.I. Journal No. 108, Vol. xxiv.

The need for assuming a defensive formation, and entrenching the convoys, can principally be felt where the size of these are out of all proportion to the escort detailed for their protection, where the morale of the troops has been rudely shaken by some disaster, and where the enemy is very numerous, cunning, and enterprising. If carried out as a system it has the serious drawback that the troops habituate themselves to a passive defence, and are with difficulty led out of their cover to assume the offensive, and, as nothing tells better than a bold offensive in a war with savages, the latter get encouraged by a tacit admission on our part of their superiority, such as seeking the protection of an entrenchment generally implies. The park, laager, etc., offers a very large target to the enemy, who, hidden in the bush, is invisible, and who can cause cruel losses firing in the brown without being seriously disturbed.

The best formation to assume for defence is that of a hollow-square the wagons and carts being ranged on the four sides, the interior space being occupied by the animals and drivers. The animals should be hobbled, or otherwise made secure, to prevent a stampede when alarmed by the firing. In this formation, the wagons, ranged axle to axle (Fig. 27), will form a very strong barrier; should the interior space be too limited, the wagons and carts may be ranged end to end (Fig. 28), a formation that will afford very much more room, though the barrier will not be so strong. A circular or oval formation would do away with the weak points which are at the angles. On occasions there may be no convenient space at hand to form up in this order; then the wagons or carts should be formed in two lines, end to end, and closed up (Fig. 29), the draught animals being taken out, and placed between the lines.

The sketch in (Fig. 30) shows a camp of two battalions protecting a cattle laager, a formation often adopted during the Zulu war. The battalions are disposed *en echelon*, so as to be able with their fire to sweep the ground in front of each face of the cattle laager. (A plan of the camp of the Flying Column in the Zulu War is given in Fig. 31).

With wagons and carts ranged axle to axle, the poles or shafts can be either turned towards the interior of the square, as shown in Fig. 27 or not. In the first case the formation of the wagon-barricade is not so rapid and it will take longer to break up the barricade and move off. Where the poles can be removed and the shafts turned up, the wagons had better face outwards. In forming in echelon it would be so, and the harnessing and moving off is thereby made easier. If the wagons are ranged end to end, the poles or shafts of each should be secured under the body of the one in front of it. In all cases several openings must be left to allow ingress and egress, each of these openings being secured by a wagon placed across it, a little in rear, to act as a traverse. The escort, in case of attack must gain time for the convoy to assume a compact and defensible formation. Should it be impossible to form up in one mass, the convoy should be broken up into a number of small squares or circles.

Picquets should be posted all round the park at night about 300 paces off, a reserve ready to support them being detailed for each face. One reserve placed in the centre of the square might find difficulty in getting to the most threatened spot, and a separate one for each face is considered preferable. An officer should be told off to take charge of the defence of each face, and if an attack by night is expected, one-third of the whole force should be kept awake under arms.

There will be great disorder in a convoy suddenly attacked by cavalry. The enemy's troopers will endeavour to cut the traces, and even hamstring the animals; it is therefore in such cases most necessary

to attend first of all to the safety of the animals. The quickest and best disposition to take is to form a double line of carriages facing inwards (Fig. 32), a formation that will permit of the column of route being resumed in the shortest space of time.

Parking from column of route (as in Fig. 28), the first twelve wagons form the front face. As the wagons arrive on the ground, the first goes to the right, and forms the right of the front face, the second to the left and forms the left of the front face, the third to the right, the fourth to the left, and so on alternately; the twelfth wagon forms a traverse. Of the next twenty-four every alternate one goes to the right, the others to the left, forming the side faces; Nos. 11 and 12 are for the traverses. The last twelve form the rear face, moving alternately to the right and left, as laid down for the front face. The last wagon of all forms the traverse.

All these formations in case of attack are, however, dangerous when the articles in the wagons and carts are powder or combustible stores; in such cases, the best that can be done is to park the convoy in one mass (Fig. 33), concealed if possible, and remove the animals and men to some place close by, where they will be safe in case of explosion, there to await until the attack is repelled.

The more the convoys are liable to be attacked, the greater the need for some special training, which will ensure the wagoners assuming certain formations rapidly with the least degree of confusion. Here the drill so much deprecated in the transport is imperatively necessary. It takes a certain length of time to park, and the infantry escort in skirmishing order should be able to gain sufficient time for the wagoners to do so, but, once the order to form the park is given, no time should be lost, and only trained men can take up their position calmly and quickly.

When on the approach of the enemy a convoy has assumed one of the above formations, as soon as the enemy retires and the attack is repulsed, the march should be resumed. This should, however, be done with caution, lest the enemy's retreat should be only a feint, intended to be turned into an attack, with better chance of success, as soon as the convoy is again in motion. The best way of attacking a convoy is to take it by surprise, particularly in a defile; great care must therefore be observed when approaching one of these places; scouts and parties from the escort should move forward to search the ground thoroughly, the heights on both sides being occupied. In every case scouts should be sent well to the front and flanks to keep a look out, and give timely warning of the approach of an enemy. Convoys having to move along a road commanded by hills on both sides, as, for example, in the mountain passes on the North-Western Frontier of India, should not enter the defile until the heights on both sides have been occupied by the troops, when they can proceed with safety.

Arriving at the end of a march close to a village, bridge, or defile, a convoy should always be encamped on the furthest side of these, for it will be found better to issue from these difficult places, whilst the convoy has already attained an orderly formation, than to encounter the difficulty on the morrow at the commencement of a march. A convoy or large transport train should never halt for a long rest on the public roads, it should always be taken off the road for that purpose.

It is essential that all convoys going to the army should not be retarded or detained in transit. Every facility should be given to each to reach its destination as soon as practicable, and each should be accompanied by a conductor in charge of the contents, who should never quit it, and who should render an account of all the articles that the convoy

contains to the officer who is to receive them. The officer in command should bring to notice any delays which may have occurred *en route*, stating the particulars of how they did occur.

The cavalry portion of the escort can be advantageously thrown out in extended order as flankers or scouts, but the infantry should march in complete companies; thus they will be more under control, and ready for any emergency. The spreading of the escort amongst the wagons was to allow the men to guard the baggage of their own corps, to give a helping hand to a carriage in difficulties, to readjust loads, etc.; but if carts are properly packed, the pack animals are properly loaded, and spare animals are provided, the help of the guard will be rarely needed. Regularity on the march, and a state of readiness for action will be best attained by the infantry escort marching in large groups, each group composed of one or more companies.

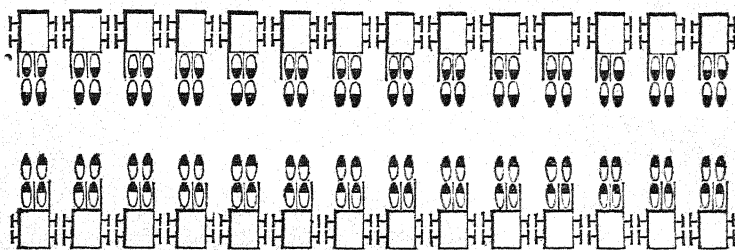
In the staging system a way of providing a large escort on parts of the road very open to attack, may be effected by a combined action between two consecutive posts, the loaded convoy proceeding under escort from the lower post being met and relieved half-way by the escort from the next post which is protecting the returning empty wagons, or unpacked animals. The escorts merely change charge, and return to their respective posts. Empty wagons should always give way, and clear the road for the passage of the loaded ones: if the road is narrow the empty wagons must quit it.

It is generally laid down that the heavy portion of the transport of an army should move by night, when the roads are clear of the troops; but it should not be forgotten that it is a different matter marching by night from what it is marching by day. Marches in dark nights are slow, for sleepiness overcomes all, and the darkness increases the weariness by rendering the journey more monotonous; the animals, having to walk with greater care, endure additional fatigue, the habits of their lives are disturbed (for they are thus deprived of their night's rest) and the drivers are less attentive. As a rule great heat is less fatiguing than a march by night, and it takes nearly twice as long to march by night than it does by day. For these reasons it will be as well not to move convoys by night when it can be avoided; whenever it is imperative to do so, reliable guides should be procured and placed at intervals in the column, to guard against any part abandoning the right road. In moving through hostile districts liable to attack convoys should never march in the dark.

In tropical climates it may be necessary to march by night; if not, the convoys should start at daybreak, marching till about 9 or 10 A.M., when a halt should be made in some locality where shade, water, and grazing can be found. Here the animals should be watered and fed, and the drivers should prepare their meals, the march being resumed when the great heat of the day is over.

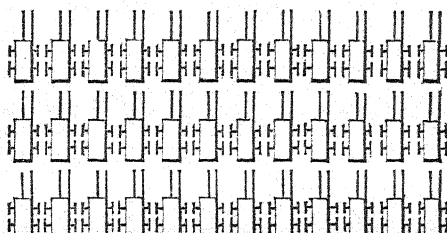
During the continuance of bad weather, periodical rains, etc., large transport movements should be avoided, as a serious risk is incurred of loosing a large number of cattle, owing to the terrible fatigue the animals will have to undergo, whilst at the same time the roads get destroyed not being in the best condition to stand the passage of heavily laden carriages.

FIG. 32.



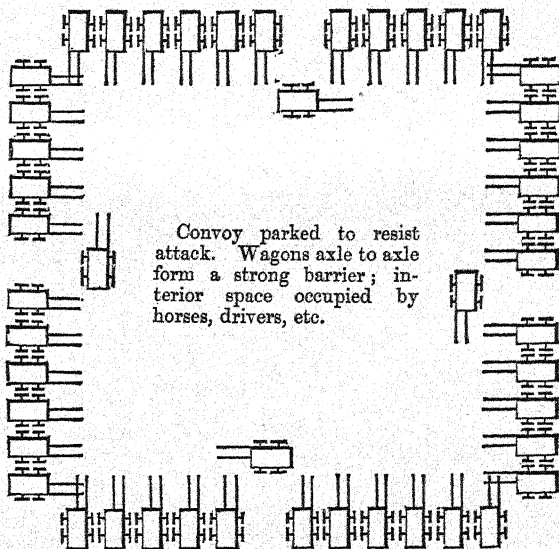
Convoy attacked by Cavalry. Quickest possible formation, two lines facing inwards; from this formation the Column of Route is easily resumed.

FIG. 33.



Convoy with powder or other combustible stores parked in mass, horses and men moved some way off during an attack.

FIG. 27.



Convoy parked to resist attack. Wagons axle to axle form a strong barrier; interior space occupied by horses, drivers, etc.

FIG. 30.

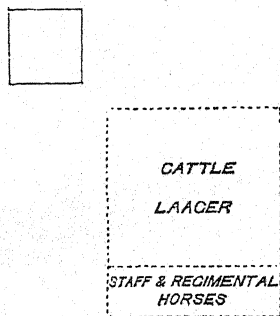


FIG. 28.

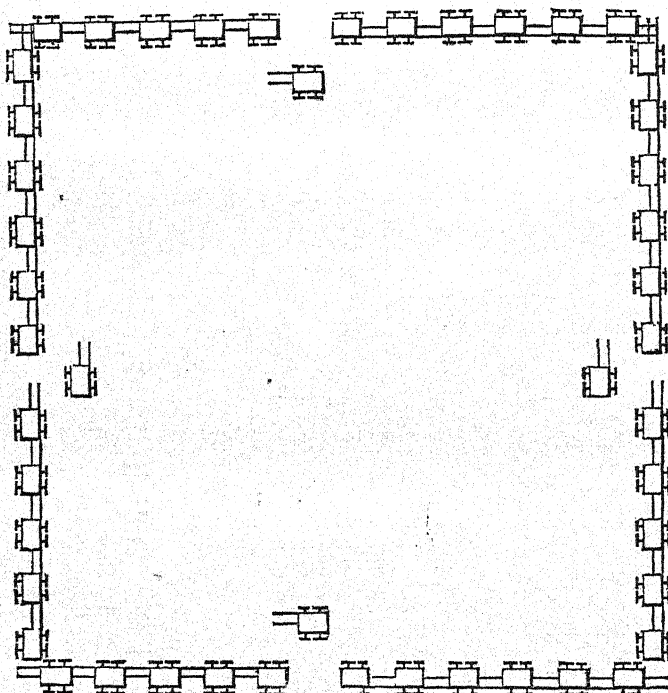
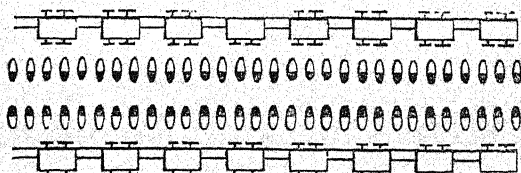


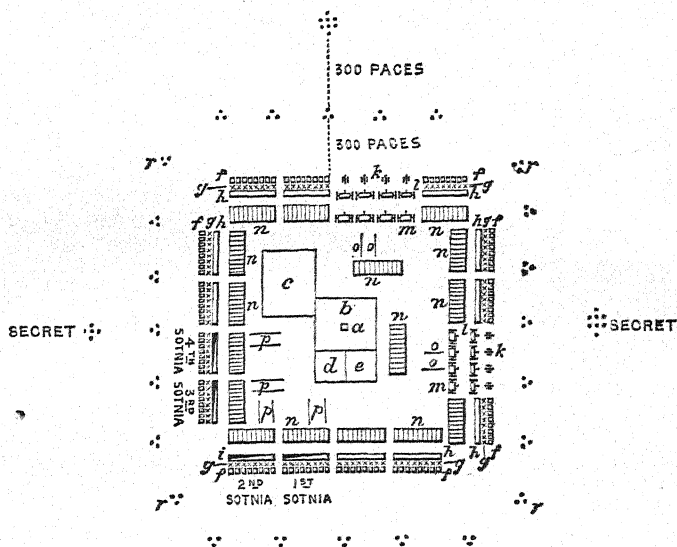
FIG. 29.



No convenient place to park. Convoy reduced by taking out draught animals forming two ranks and

FIG. 25.

NORMAL BIVOUAC IN CENTRAL ASIA



SECRET

- | | |
|-----------------------------|---------------------------|
| a. DETACHMENT COMMANDER. | i. COSSACKS. |
| b. " STAFF. | k. GUNS. |
| c. HOSPITAL. | l. LIMBERS. |
| d. ARTILLERY PARK. | m. AMMUNITION WAGONS. |
| e. ENGINEER " | n. CAMELS. |
| f. CAMEL PACKS. | o. ARTILLERY HORSE-LINES. |
| g. PILED ARMS. | p. COSSACK " |
| h. COMPANIES IN OPEN ORDER. | r. PICKETS. |

FIG 31.

PLAN OF CAMP OF FLYING COLUMN.

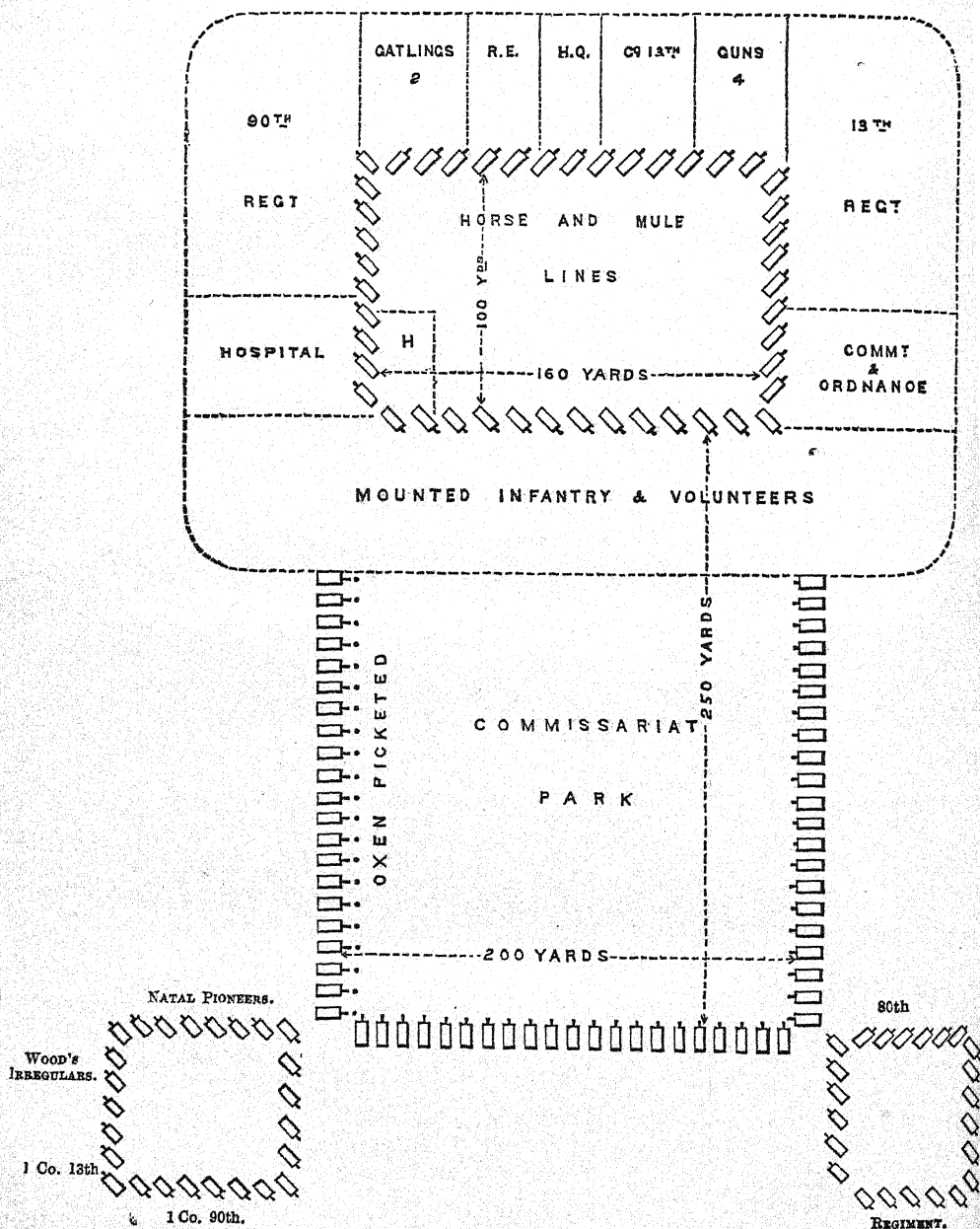
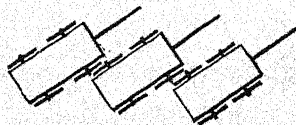


FIG. 26.



APPENDICES.

APPENDIX I.

REPORT BY CAPTAIN HOLLAND ON MULE SADDLES USED DURING THE ABYSSINIAN EXPEDITION.

THE following report, dated Zula, 10th June, by Captain T. J. Holland, Assistant Quartermaster-General, on the different descriptions of mule saddles and pads used by the force during the march to and from Magdala, with sketches, shows the relative merits of each.

"The following saddles and pads have been used by the force for mules ;

Saddles.

- "The Otago.
- "The MacMahon.
- "The Hungarian.

Description
of saddles.

Pads.

- "Punjab.
- "Bombay Ordnance.
- "Bombay Commissariat.
- "Egyptian.
- "Persian.

"The Otago saddle weighs 43 lbs., and is admirably adapted for general pack purposes, when used by properly instructed muleteers ; it, however, requires to be carefully fitted on the animal, and every attention given to adjusting the stuffing of the pads, so as to prevent any chance of galling.

The Otago
saddle.

"The Otago saddles sent to Abyssinia have, as a rule, been too large for the mules in use with the force. The breeching, breastplates, buckles, and straps might be reduced and simplified. Muleteers, unless trained and accustomed to these saddles, are apt to make mistakes in fastening the straps, &c.

"With very slight modifications, and in proper hands, these saddles ought not to gall when fitted on the large Spanish mules, but the smaller animals with the force, as well as those in poor condition, have been frequently laid up with sore shoulders and hips, on account of these saddles being too large for them.

"Three sizes of Otago saddles have been sent to Abyssinia, of which those of the smallest pattern have answered best, and saddles of a still smaller pattern would probably answer better for Indian mules.

"From the experience we have had, the following alterations would appear advisable in the Otago saddle :—

Alterations
suggested.

"1. Strong loops of leather might with advantage be substituted for the hooks from which the loads are suspended and fastened; these loops should be two inches higher on the tree of the saddle on each side than the hooks now are, so as to distribute the weight of the load more on the animal's back and less on his sides. Nothing fatigues and distresses a mule more than a badly-packed and loosely hung load knocking against his flanks and legs.

"2. A netting, or saleeta, should be furnished to 25 out of every 100 saddles, to carry miscellaneous articles, small packages, &c.

"3. Breeching and breastplates should be made more simple, buckles and straps reduced in number, and all constructed so as to fit any sized animal; the present breastplate and breeching are too long for even the largest mules we have had, and in most cases cannot be sufficiently shortened.

"4. That part of the pad of the saddle which rests on the animal's shoulder should be cut out, so as to lessen the chance of galling, and give the shoulders fair play to work clear of the pads. The same arrangement might with advantage be made in the hinder part, to prevent the hips from being rubbed. The stuffing of the pad should also be of softer material, and should project on all sides beyond the leather, the edges of which are liable to turn in, harden, and injure the mule.

"5. A horse blanket, carefully fitted in the fork of each saddle, is required to protect the mule from the cold at night, but is not required in saddles provided with saleetas, as the saleetas can, if made of canvas, be used as horse-cloths."

"The Otago saddles sent to Abyssinia have been very well made, of the best material, and would, with the modifications above suggested, be the best pack-saddles for mules yet invented.

"For riding purposes these saddles are not very well suited; the hooks on them are very much in the way, and in the event of a fall, are liable to catch the riders clothes and, as has occasionally happened in this campaign, cause a bad wound in the leg.

"The Mac Mahon saddle weighs 66 lbs. with its waterproof sheet, or 56 lbs. without the sheet. It has many of the advantages of the Otago.

"Its weight, however, is so considerable that it renders it an inconvenient description of pack-saddle, especially where, in order to economize the number of mules, it is a matter of great importance to place as much baggage on each as the mule can carry with facility.

"A Hungarian saddle, brought to Zula by Count Kodolitsch, one of the Austrian officers attached to this force, has only been tested on the march to and from Magdala. It is a simple light framework of wood and iron, weighing 17 lbs. only, and is placed on a folded horse cloth on the back of the mule. It has the advantage of being very light, and so constructed as not to be likely to cause galls.

"It is, perhaps, as good a description of pack-saddle as there is for carrying two boxes of an equal weight, but it is not suited for bundles or packages.

"The ordinary Punjab pad is covered with leather, and weighs 34 lbs.; it is in two pieces, with bands over the back to connect the two portions together. The breeching and breastplates are of broad leather.

"This pad has been found by long experience to be very serviceable, and does not generally gall mules. In a mountainous country, however, like Abyssinia, it has not altogether answered well, as there are no means to prevent loads slipping backwards or forwards when going up or down hill.

The
MacMahon
saddle.

The
Hungarian
saddle.

The Punjab
pad.

"This defect might be remedied by having bamboos lashed on each side, or by passing straps through eyelet holes in the upper part of the pad. Alterations suggested.

"The Punjab pad is simple and light in construction. Muleteers soon learn how to fasten it on, and it has on the whole caused less galls than any other pad or saddle in use with the force. I would recommend it for use all over India, as the lightest, most serviceable, and economical pad obtainable.

"The following alterations are, however, suggested:—

"1. The felt pads which rest on the mule's back to be covered with some soft cloth.

"2. As it is impossible that the bands connecting the two pads can be made strong enough for very rough work, it would be advisable to join the pads strongly together by one band, running the whole length of the saddle.

"3. Eyelet holes to be added to the front and back part of the pad, with a view of preventing the loads from slipping; a strong piece of double rope sewn on to the sides of the saddle, with loops left at either end, would answer all requirements.

"The Bombay Ordnance pad is covered with strong sacking, and weighs 26 lbs. It has not proved at all a good pad; it is too thin to be any protection to the animal's sides or back, and totally unsuited for hard loads, such as shot and shell, or other articles that press on one spot. Long marches try it greatly, and more sores and galls have been caused in this campaign by this pad than by any other. The Bombay Ordnance pad.

"The Bombay Commissariat pad is also covered with sacking, weighs 40 lbs., and is commendable for its simplicity, durability, and the protection it affords to the animal's back, but it is objectionable on account of its great weight. The Bombay Commissariat pad.

"It is, moreover, clumsy and unwieldy, and gets very heavy when saturated with rain. It, however, has not been found to cause many sore backs in this campaign. The Bombay Commissariat pads sent to this country have, as a rule, been badly made, the breeching, breastplates, and girths deficient in strength, and the pads generally requiring constant repair.

"The Persian pad is covered with hair sacking; it is thick and rather clumsy, but it has not been found to gall animals much, and weighs 25 lbs. The Persian pad.

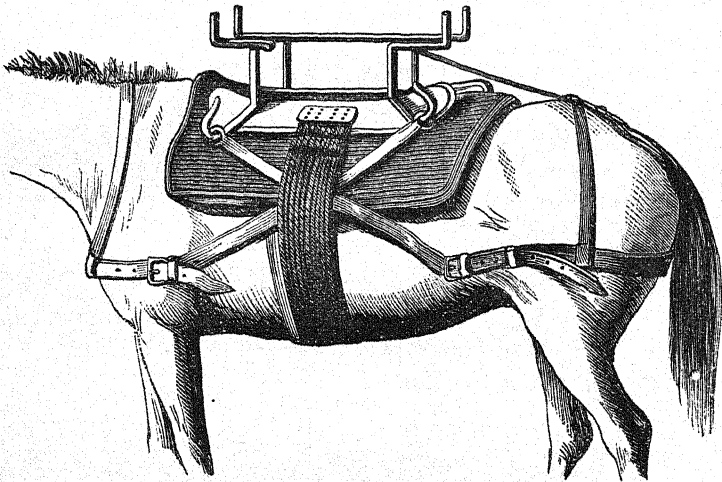
"The flap of carpet cloth attached to this pad, and which covers the loins and hind quarters of the mules, effectually protecting them from the wet and cold at night, is of great advantage. The Persian pads sent to this country have generally been made of very flimsy material, and have not stood the constant wear and tear they have had.

"The Egyptian is a high, hard, uncomfortable, and heavy pad, quite unsuited to the requirements of a campaign. It was found necessary at the commencement of the operations in this country to condemn all the Egyptian pads sent to Zula. The Egyptian pad.

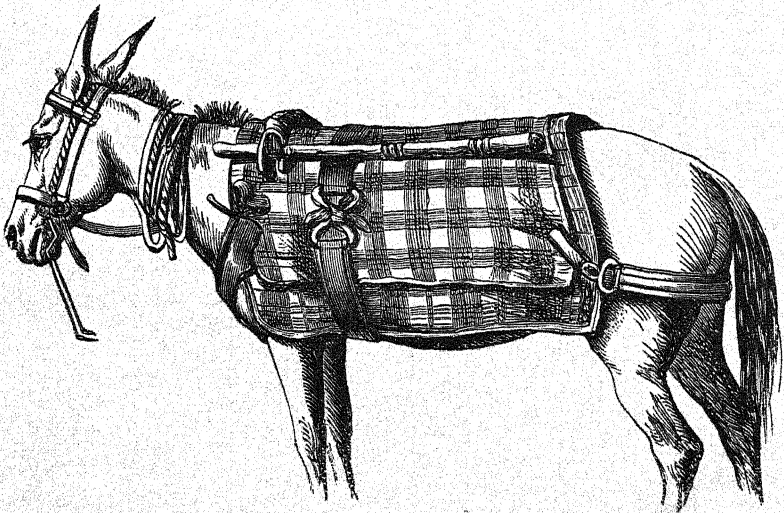
"From the experience we have had in this campaign, the Otago has proved the most serviceable of all mule saddles, and the Punjab the best pad.

"I believe that a pad is better than a saddle, as a general rule, for pack purposes, being more easily repairable, better capable of being fitted to mules of any size, carried with greater facility to the post from which it is to be used, lighter in weight, and is simpler, and far more economical in construction; it also affords protection to the mule at night, which the saddle does not.

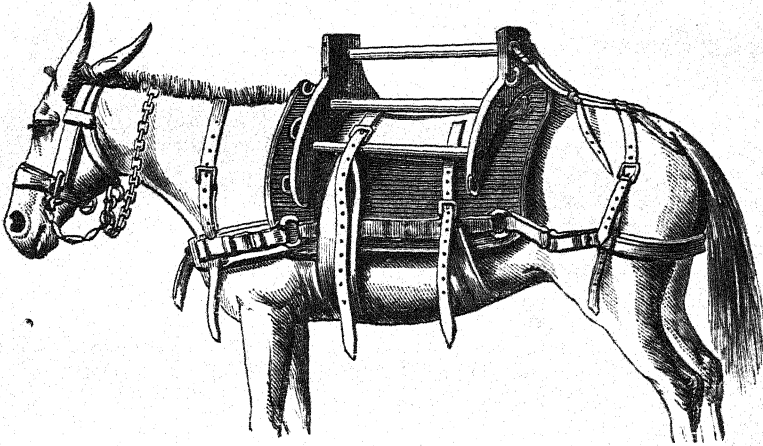
HUNGARIAN SADDLE.



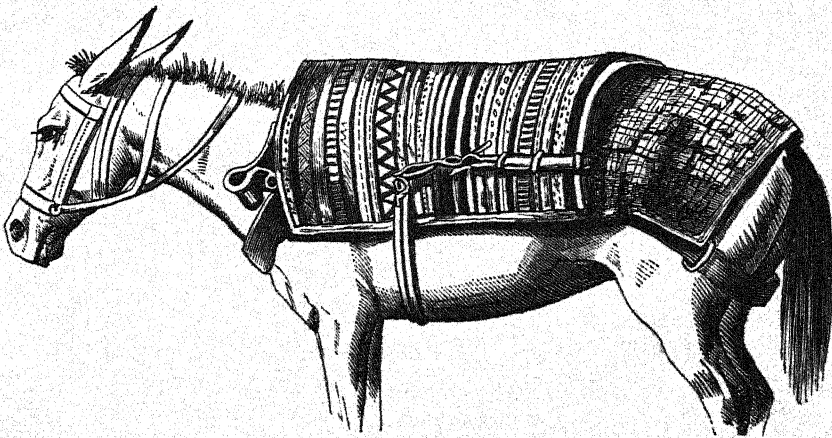
THE BOMBAY COMMISSARIAT PATTERN PAD.



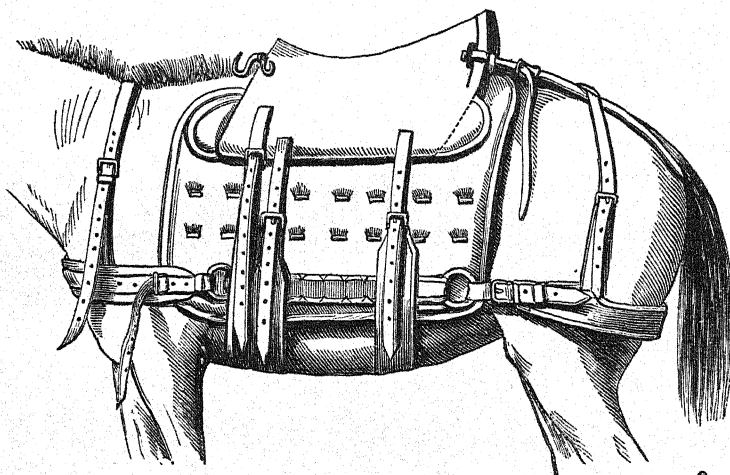
THE McMAHON SADDLE.



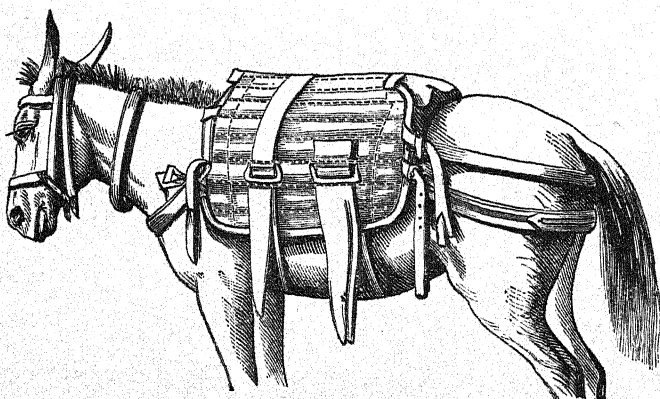
THE PERSIAN PAD.



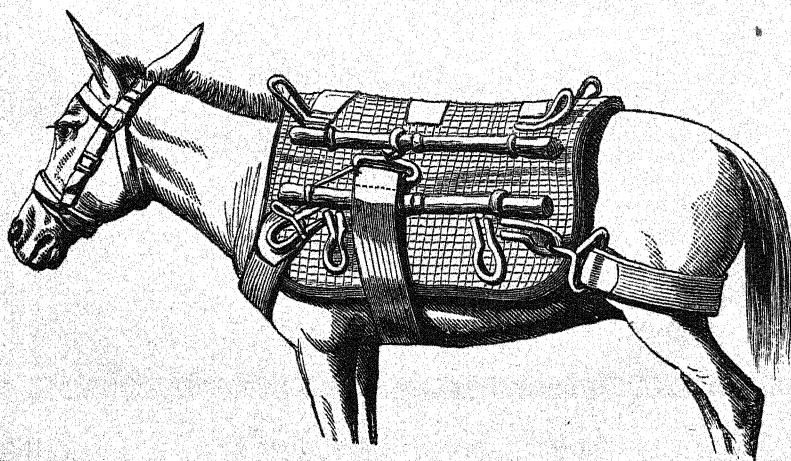
THE OTAGO SADDLE.



THE PUNJAB PAD.



THE BOMBAY ORDNANCE PATTERN PAD.



"When saddles get out of order they are difficult to repair; the leather which covers them is liable soon to get damaged when in the hands of muleteers, who, tired with their long marches, content themselves with simply taking them off their animals, and never give any attention to keeping them in good order. It would, however, probably be advisable in a mule train for service in a mountainous country to have a proportion of saddles as well as pads.

"Sketches of each description of pack-saddle and pad reported on are attached.

"Having thus reported on all the saddles and pads sent to Africa for the use of the force, I would, as a suggestion on this most important subject, offer an opinion that it appears highly desirable that a better description of pack-saddle than any we have had in use should be introduced into our Transport Trains. All our pack-saddles have defects which might be remedied, but I cannot help thinking that if we adopted another description altogether, we might not only save considerable outlay in original cost, but also be able to reduce the number of muleteers, and at the same time place heavier loads on our mules. A pad made of leather, of the shape of a large pair of saddle-bags, filled with straw and girded on the mule with a broad girth, would, I believe, prove a far better pack-saddle than any we have had on trial in Abyssinia.

"Count Kodolitsch, one of the Austrian officers attached to the force, who has served in Mexico, has informed me that such a description of pack-saddle is used by the Mexicans, and styled an 'apparejo,' each side of it being sufficiently deep to keep the girth from chafing the belly, and the crupper, attached by wide side pieces, renders it difficult for the saddle to turn when the load is on.

"In Mexico, loading is, I believe, very simply managed. A sling rope is thrown across the 'apparejo,' and the loads placed on the mules back, the sling rope being tied on the top. In Mexico one muleteer is able to attend on the march to eight mules thus laden.

Apparejo
recommended.

"The advantages of a pack-saddle of the above description are that, its cost is but little, large numbers can be packed in a comparatively small compass, and sent to the port of debarkation; each mule can carry a spare pack-saddle unstuffed. Repairs can with facility be effected. Its size distributes the weight of the load over the whole of the animal's back. It is not liable to turn. It serves as a covering at night for the mule, and by care and attention in arranging the straw stuffing ought never to cause galls or sore backs."

APPENDIX II.

EXTRACT FROM "REPORT OF KABUL COMMITTEE ON EQUIPMENT."

Colonel Low's Report.

THE saddles in use in the Transport are mentioned in attached papers in the following order, and their advantages and disadvantages are briefly as follows :—

1. Transport Ordnance Pack-saddle.—This is the best saddle we have; the spine of the animal is nowhere touched, and it is suitable when made in different sizes to any animal. It has conclusively been shown to be the best in use, and can be used by inexperienced hands, which is a *sine quâ non* in a large transport.

2. Kandahar Pad.—This is the most defective saddle, next to the Bombay pad. It does not require so much looking after as some of the following. But while it is slightly raised off the withers by being sewn up or pinched together in front, yet the crupper end rests on the spine, and it cannot be used without giving a sore in that place.

3. Soonkha Saddle.—The advantages of this saddle are many; it can be made of anything almost and easily repaired; and is an excellent saddle in hands accustomed to use it. The protection to the spine is perfect, but it is only suited to animals with low withers; and though in experienced hands this is corrected by extra rollers, &c., yet in inexperienced hands, and where the drivers are not interested in their animals, it is a failure; and gives them crushed withers, especially in the animals with high withers, such as yaboos and down country ponies.

4. Palan or Afghan Saddle.—These are excellent saddles also, but only in the hands of Afghans. The protection to the spine is good, but they require the stuffing which is only bhoosa, being looked to daily. This the Afghan syce is in the habit of doing, but directly it gets into other hands it fails and causes sore backs.

5. The Bombay Pad.—This is the worst saddle we have; the spine is nowhere protected; but the pieces of bamboo are trusted to take pressure off the spine. This does not however happen, and the bamboos are constantly falling out and cannot be renewed on the line of march.

(Signed)

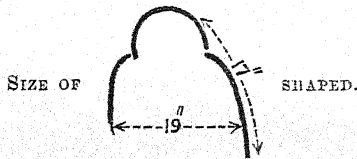
R. C. LOW, *Colonel,*

Chief Director of Transports.

SADDLES.

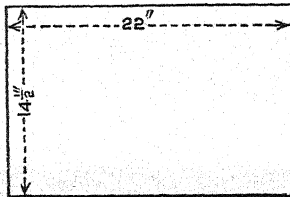
LENGTH OF IRON FRAME WORK.

15 INCHES AT TOP.
17 „ BOTTOM.

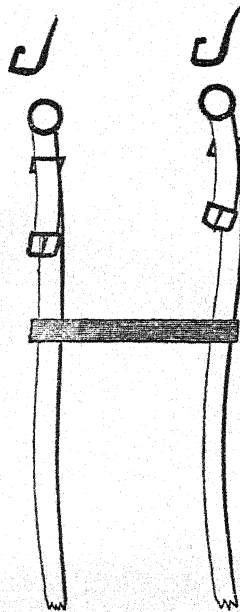


IRONS AT EACH END OF SADDLE,
THE REAR ONE BEING A LITTLE WIDER,
= $22\frac{1}{2}$ INCHES.

SIZE OF PADS UNDER FRAME WORK.



HOOKS OF SADDLE.

*Transport Ordnance Pack-Saddle.*

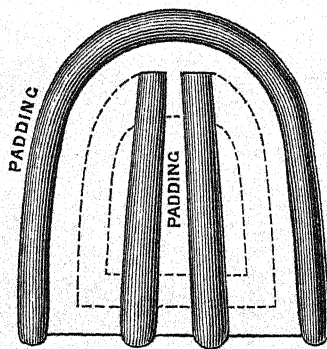
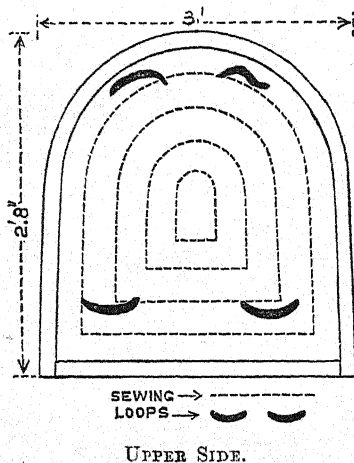
1. The *Transport Ordnance Pack-Saddle* consists of a framework of iron, in two V shaped pieces, connected together by two round and two flat iron rods; one on each side near the apex of the V, and one on each side at the bottom of the V iron; between these two V shaped iron pieces are again connected by means of a piece of flat wood about three and a half inches wide and half an inch in thickness; the framework has a padding under it, which on the outside is made of thick leather, and on the inside of blanket padding, stuffed with wool; the stuffing being sufficient to prevent the saddle slipping too low on the animal's back. Through the piece of wood above mentioned run two leather straps on each side, held in by a plug on the outer side of the wood; to these straps the girths are connected, and passing under the animal are tightened by the same means on the opposite side.

About four inches from the top of the V shaped irons are two hooks on each side of the saddle; to which are attached the loads, bound in leather straps, the straps being hooked on by rings to the hooks.

At the ends of the V shaped iron are rings to which are attached hooks, and to these hooks the breeching straps are joined on; the breeching straps consist of double leather, about four inches wide and have rings and chains at each end for lengthening and shortening the straps, according to the size of the animal; the crupper is attached to the rear V shaped iron of the saddle (which is a little wider than the front iron to sit better on the animal), at the apex, and is constructed on the principle of a girth, so as to allow of shortening or lengthening. The pads are kept in place by being attached to the wooden pieces, connecting the two V irons; and also by small straps going through

loops in the leather, and over the flat iron joining; the leather straps for loading are kept together on each side by another narrow strap connecting them, keeping the straps at such a distance from one another as to allow of their just fitting into the hooks (3).

KANDAHAR PAD.

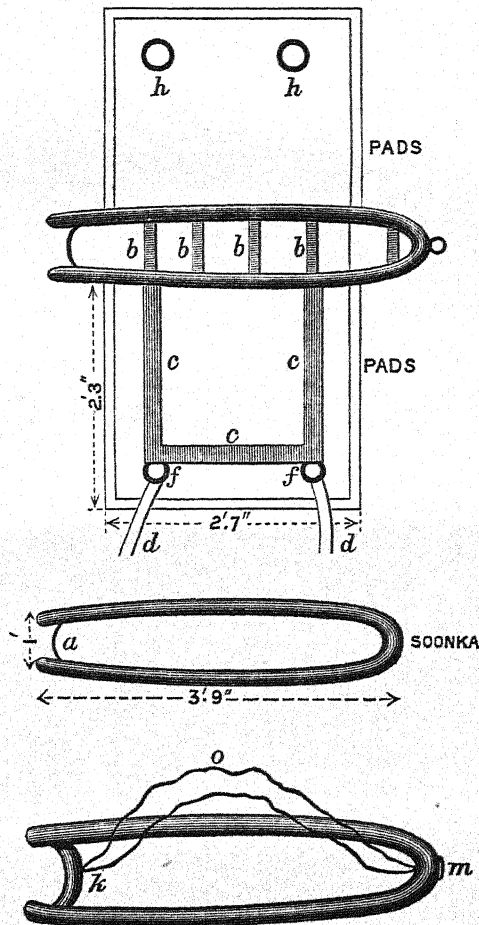


KANDAHAR PAD.

2. The *Kandahar Pad* consists of a large pad, the outer side of which is made of gillun and the remainder of blanket, connected to it in layers; the whole pad being about $3\frac{1}{2}$ inches in thickness; the layers are sewn together with twine throughout; small loops of string being attached to the lower ends of the pad for breechings, which consist of newar; under this layer of padding on the lower side (or the one which rests on the horses back) run pads all round the saddle, and up the length as per diagram; these are to prevent too much rubbing on the animals back. Over the top of the side and along the entire length run two sticks about two and a half inches wide and three feet four inches long, attached to the saddle by loops; these are to take off the pressure of ropes in any one part.

The saddle is kept on the pony by a girth going round the centre of the palan; this girth is separate and not in any way attached to the palan.

SOONKA SADDLE.

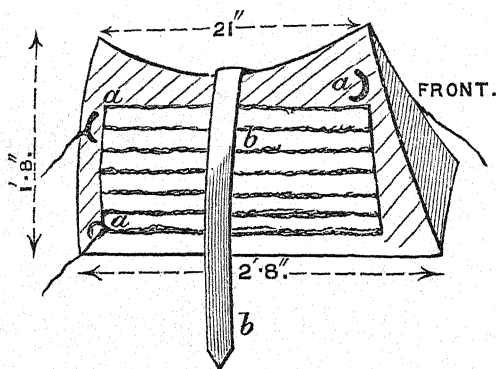


SOONKHA SADDLE.

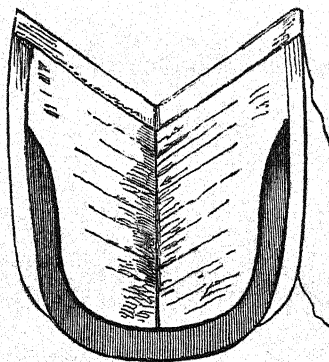
3. The *Soonkha Saddle* consists of a soonkha (as per diagram) made of gillun and stuffed with straw, kept together at the open end by a loop (a). Attached to the soonka are two pads, (dimensions in diagram) made of gillun lined with with blanket and stuffed with various materials, (tow, old rags, straw, &c.); *b b b* are strips of leather connecting the pads together; *c c c* wider strips of leather sewn on to the gillun of pads; *f f* the iron rugs for breaching straps, which consist of leather about four inches wide, and which can be shortened or lengthened on the principle of a girth; on the other pad (which is made exactly as the one described), the rings *h h* are used for the girths, which are fastened underneath to *f f*, by means of thongs for shortening or lengthening.

From *m* to *k* run two cotton ropes, which are tied down tight on to the load to prevent its slipping backwards or forwards.

PALAN SADDLE.




VIEW OF UNDER PART OF SADDLE.



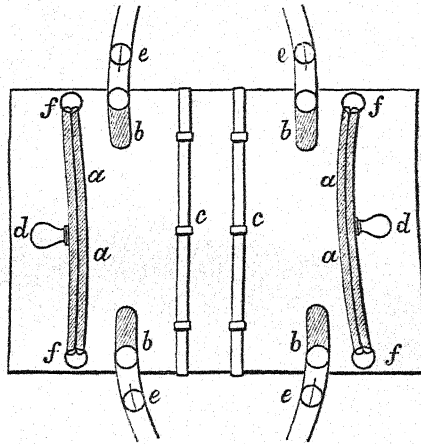
THE DARK SHADING SHOWS RAISED PAD STUFFED WITH STRAW.

PALAN SADDLE.

4. The *Palan Saddle* is a saddle made on the principle of the iron pack-saddle, as far as sitting purposes are concerned; that is, it endeavours to take the weight off the back entirely and place some of it on the side of the animal. It is, however, made entirely of gillun stuffed with straw and kept in its position  by means of tightly stuffed pads underneath; it has string loops as *a a a*, for fastening the breaching straps, which are made of newar webbing; a girth of newar webbing goes round the saddle as at *b b*.

Padding of saddle and raised pads to keep off the rubbing on animal's back, (as per diagram).

BOMBAY PAD.



BOMBAY PAD

5. The *Bombay Pad* consists of a plain pad (dimensions as per diagram); the outer side is made of thick sack cloth or gillun, the under lining of country cloth (dusootee); the stuffing consists of cocoanut hair and a lining of numdah above it; *c c*, are two pieces of bamboo, kept down by leather thongs; *b b* are leather pieces with rings attached for the breast band and breaching straps; *a a* are twisted rope sewn down to the saddle in two pieces; *f f* and *d* are loops covered with leather for tying down the loads to; *e e* are the straps for the breast bands and breeching straps. The saddle is kept on the animal by wide girth of newar webbing, going round near *d c c d*, and under the animal. The breeching bands are made of leather about three and a half inches wide.

APPENDIX III.

THE APAREJO PACK-SADDLE.*

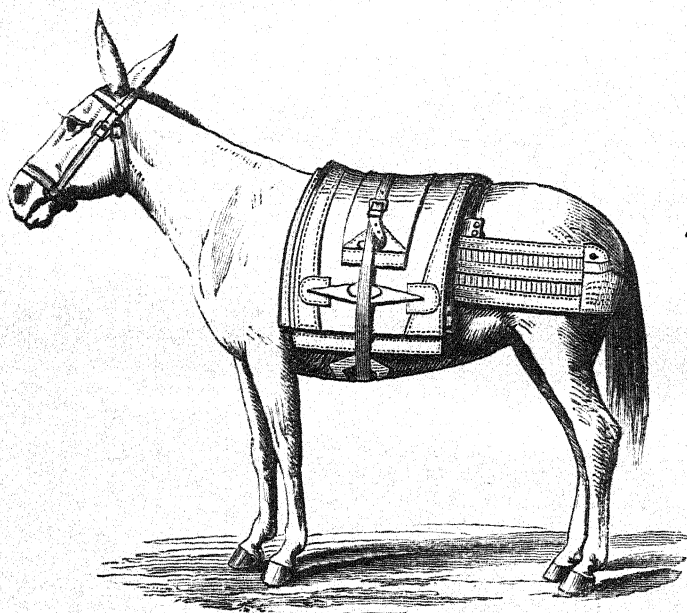
The *Aparejo*, originally used by the Mexicans as a pack-saddle, has been much improved by the packers of the United States and is now considered about the best pack-saddle to use in freighting.

The *aparejo* consists of a long strong sack of leather, about 20 inches wide and from 56 to 62 inches long, according to the girth of the animals. A seam divides the sack into two equal parts, terminating in a peculiar double seam at the front, which protects the withers of the mule from being unduly pressed. The pack-saddle is made ready for use by the following process. Into each half of this leather sack from the inside, through a hole cut near the centre, are first placed willow, hazel, or ash sprouts, $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in diameter at the butt

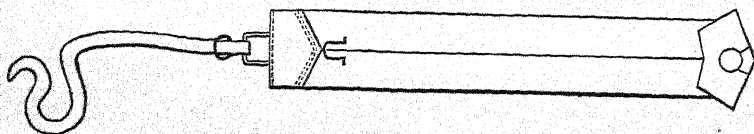
* Compiled from a pamphlet by Thomas Moore, "Instructions for using the *Aparejo* or Spanish Pack-saddle," and from articles in the *New York Army and Navy Journal* of the 2nd July and 20th August, 1881.

and $\frac{3}{8}$ to $\frac{1}{2}$ an inch in diameter at the small end, running lengthwise butt end down and carefully placed at equal intervals, thus creating a stiff and even surface on the outside.

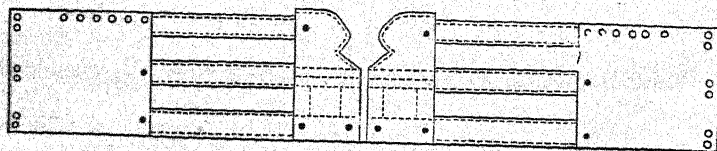
This is called *sticking* and should be carefully done. Five or six of the heaviest sticks should be in front, and after all the perpendicular sticks have been placed in position, a strong stick of hard wood $\frac{3}{4}$ of an inch thick and $1\frac{1}{2}$ inches wide, slightly rounded at the corners and ends, but $\frac{3}{4}$ of an inch shorter than the width of the aparejo at the bottom inside seem, is forced in a horizontal position to prevent the aparejo from rounding out.

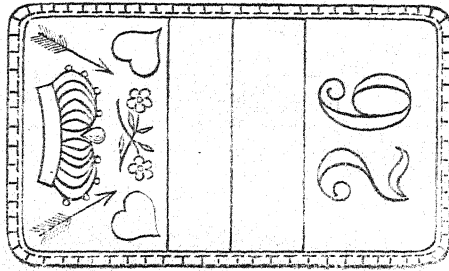


MULE WITH APAREJO.

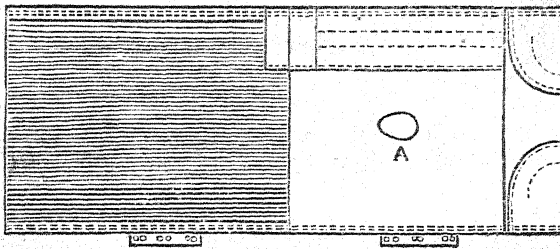


CINCH.





CORONA.



APAREJO.

On the inside and towards the mule's back are inserted layers of soft, springy hay, varying from $2\frac{1}{2}$ to 4 inches in thickness; the variations in thickness being governed in each case by the peculiarity of the conformation of the back of the mule for which the particular aparejo is intended. The packers for this purpose seek fine slough grass cut after the frost has caught it; the hay used by upholsterers in stuffing lounges and mattresses is about the stamp of hay needed.

Under the saddle is placed the corona or saddle cloth, to which is slightly stitched on the underside a sweat cloth of light canvass, 22 inches wide, over the corona is arranged a folded blanket.

The corona, which is wider than the aparejo, but not so long, is made of three thicknesses of common blanket, 24 inches wide and 40 to 44 inches long, the three pieces are purposely cut of unequal lengths, viz., 40, 42, and 44 inches long, not to form a too abrupt termination. The outer or top blanket is usually of a bright red colour, and on this the number of the aparejo is sewn in large figures of light coloured leather on one side, the other side being ornamented with devices according to fancy.

The saddle blanket goes, as has been said, on the top of the corona, and should be a fair good bed blanket, $5\frac{1}{2}$ feet wide and from 7 to $7\frac{1}{2}$ feet long. In folding it for use, it is held at each corner and doubled to half its length, then doubled again in the opposite direction to three double thicknesses. The blanket when folded thus will be 22 inches wide and from 42 to 45 inches long.

A cinch or girth ten inches wide, not attached to the aparejo, passes loosely over the

diaphragm: this cinch offers a wide surface for the mule's belly. A wide crupper is attached to the saddle and extends over the hips presenting a broad surface which prevents chafing.

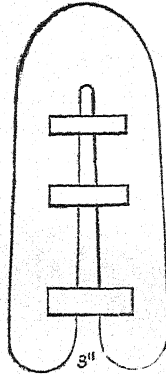
With the American packers it is one man's business to lift the aparejos from all the animals of a train at the conclusion of a days' march. As this man (called *cargadore*) removes the corona and sweat cloth off each animal, he carefully observes how the aparejo has been working, as indicated by the perspiration on the back; he then and there marks with wet earth, or other temporary means, the particular part where the hay stuffing needs attending to. No permanent marks are put on the inside of an aparejo as these might lead to confusion, when on a future occasion the pack-saddle requires refixing. If the animal is bruised or chafed the *cargadore* spits on the hurt and sets the aparejo on in the position it works in; the spittle will show him where the saddle requires fixing.

The aparejo protects the mule's sides as well as the back, it presents four times the number of square inches for equal pressure to the animal than the common pack-saddle does, whilst the shape of the aparejo affords an opportunity to balance the load; thus 100 lbs. on one side can be made to ride with 60 lbs., on the opposite as well as if they were of equal weight, thus preventing any unequal strain on the animal. However badly shaped the mule's back may be, an experienced packer can manipulate the filling in of the sacks so that it will fit the animal's back as nicely and as smoothly as a glove. Animals can be worked with a bruise or a sore by removing the hay from the interior of the sack over the parts where the bruise is, leaving a space which, when the saddle is on the mule's back, forms a kind of a cup or hollow over the injured part without pressing or further irritating it.

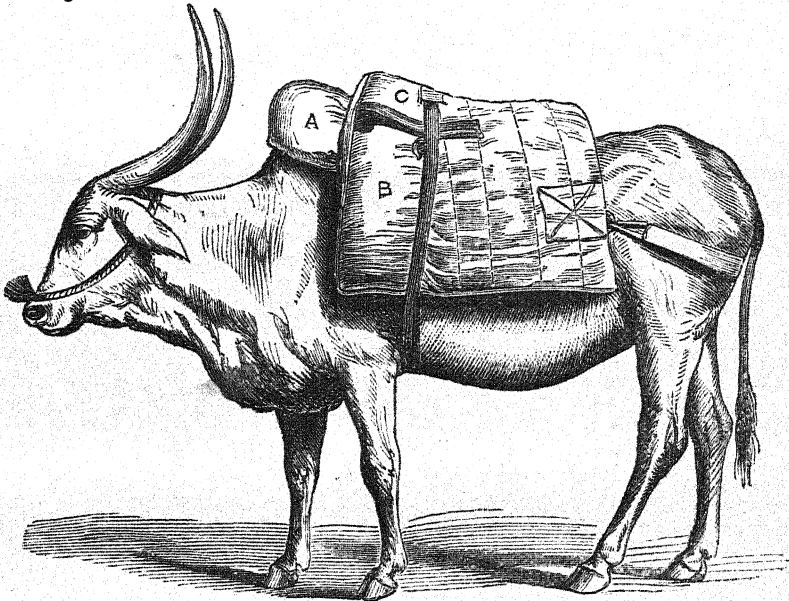
American packers are very methodical in their working; the division of work amongst the men, the arrangement of their saddles in camp, the putting on of the rigging, the careful loading of each animal in his turn, the feeding, watering, and driving of their mules, are all points that tend to secure the efficiency of their trains at all times.

The lashing of the packs demands a certain amount of experience. A description of the *modus operandi* is given in Thomas Moore's instructions for using the aparejo, but, as it is difficult to understand unless actually seen performed by skilled hands, no advantage can be derived for giving it here. Should this pack-saddle be adopted in our service it will be indispensable to get one or more experienced packers over from America to train our men in sticking, preparing the corona, lashing loads, etc.

A train of 40 packs requires eight men; one of these takes charge of the kitchen, and one herds the mules. On the march the whole are mounted on stout mules; the cook takes the lead with the bell mare, another drives up behind; the rest of the packers ride on the left side of the train, at intervals of from 20 to 30 yards, each one keeping his eyes on the mules ahead of him. If a load is not seen to ride properly two packers jump off, lead the mule bearing it to one side, rebalance the load, relash the rope, and again turn the animal loose,



PAD A.



PACK-BULLOCK, MADRAS PRESIDENCY.

APPENDIX IV.

PACK-BULLOCK—GEAR.

PACK-bullocks are largely employed for transport in many parts of India. The gear used for these animals differs, with certain modifications, not only in the three Presidencies of Bengal, Madras, and Bombay, but even in the various districts of each; of the whole, what is used in the Madras Presidency and in the Sangor and Jubbulpore

11. The throat lash is to admit the hand between it and the horse's throat.

12. The stirrups should be adjusted so that the lower part of the iron may be three fingers above the top of the heel of the boot, when the rider is in position, without stirrups.

13. The collar should be so fitted as to admit of the flat of the hand passing freely between it and the lower part of the horse's neck.

14. The hames should be bent at the bottom so as to fit the lower part of the collar, and straight from three inches below the draught-hooks, nearly to the top, when they should curve out a little. The breast chain should be so hooked that the hame strap, when buckled, may keep the draught-hooks at the proper height, according to the size and make of the horse.

15. The wither strap should not be tight, otherwise it would pull the saddle or pad forward, and tighten the crupper.

16. The trace belly band should be so buckled as to admit three fingers between it and the horse's belly when the traces are stretched.

17. The bearing straps should be so fitted as to be rather longer than is necessary, to keep the traces in line between the draught-hook at the shoulder and the trace-hook.

18. The breeching should be from 10 to 12 inches below the upper part of the dock, and when the horse is hooked in, there should be four inches play between it and the collar.

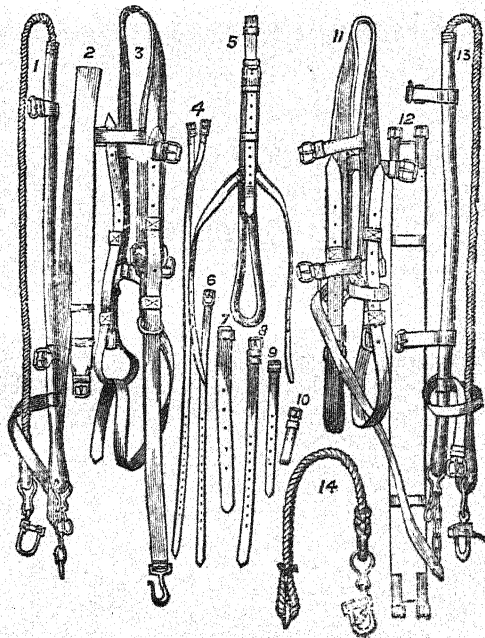
19. The back band should be of such length that the points of the shafts may be a little higher than the splinter bar, and should hang one hand's breadth below the horse's belly when the horse is placed in the shafts.

20. The length of the lead traces in a great degree depends on the size of the horses and the nature of the ground, the distance from nose to croup must never be less than one yard.

COMMISSARIAT AND TRANSPORT CORPS HARNESS.

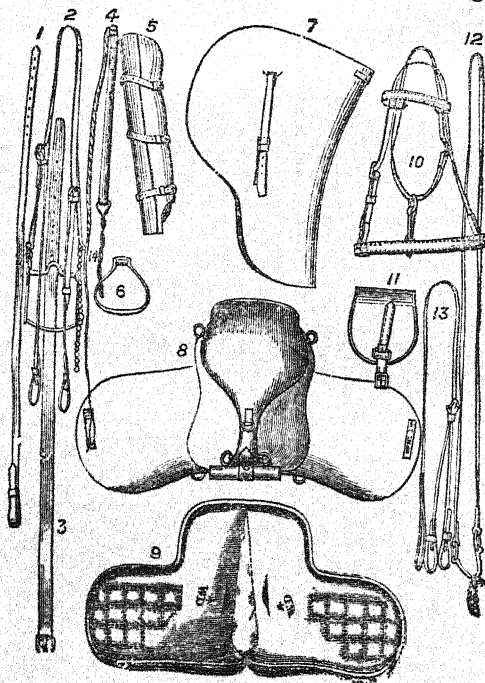
SHOWING NOMENCLATURE OF PARTS.

- No. 1. Trace, lead, neat, light.
 „ 2. Surcingle, leather, light and R.A.
 „ 3. Breeching, neat, light.
 „ 4. Straps, cloak, and wallet, light and R.A.
 „ 5. Crupper, harness, light.
 „ 6. Strap, centre cloak.
 „ 7. „ flank, light and R.A.
 „ 8. „ hame.
 „ 9. „ wither, light.
 „ 10. „ piece, buckling, light.
 „ 11. „ Breeching, off, light.
 „ 12. Girth.
 „ 13. Trace, lead, off, light and R.A.
 „ 14. Trace, short.



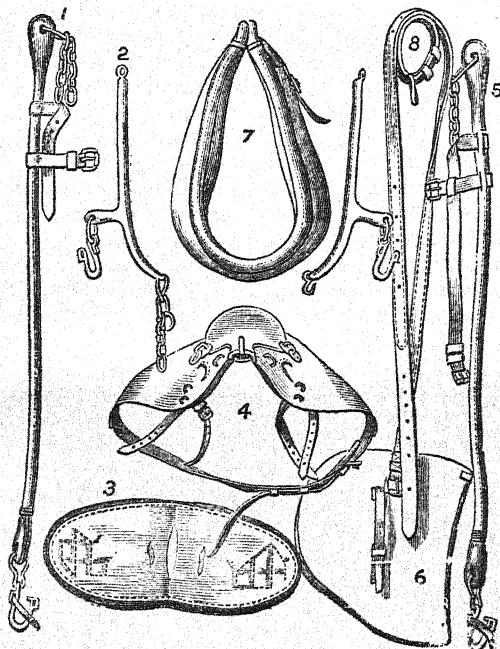
SHOWING NOMENCLATURE OF PARTS.

- | | |
|---|------------------|
| No. 1. Rein, side | } Light and R.A. |
| " 2. " bearing | |
| " 3. Leather, stirrup | |
| " 4. Whip, driver's | |
| " 5. Legging, driver's | |
| " 6. Iron, stirrup | |
| " 7. Nunnah, saddle, driver's | |
| " 8. Saddle | |
| " 9. Pannel | |
| " 10. Collar, head, stall | |
| " 11. Shoe, pocket | |
| " 12. Bit, bridoon, with rein | |
| " 13. Rein, leading | |
| " 14. Bit, harness, with hand and curb chain, light only. | |



SH WING NOMENCLATURE OF PARTS.

- No. 1. Trace, wheel, neat, light.
 „ 2. Hames, iron, light.
 „ 3. Pannels, saddle, harness, luggage, light, pair.
 „ 4. Saddle, harness, luggage, light.
 „ 5. Trace, wheel, off, light.
 „ 6. Numnah, leather-harness, luggage, light and R.A.
 „ 7. Collar, neck.
 „ 8. Tugback band tight.
 „ 9. Band, back and belly, light.



The remarks that follow relating to the proper harnessing of mules are from Mr. Harvey Riley, Superintendent of the Government Corral at Washington.

"The value of Harnessing properly."

"In working any animal, and more especially the mule, it is both humane and economical to have him harnessed properly. Unless he be, the animal cannot perform the labour he is capable of with ease and comfort. And you cannot watch too closely to see that everything works in its right place. Begin with the bridle, and see that it does not chafe or cut him. The army blind-bridle, with the bit alteration attached, is the very best bridle that can be used on either horse or mule. Be careful, however, that the crown piece is not attached too tight. Be careful, also, that it does not draw the sides of the animal's mouth up into wrinkles, for the bit, working against these, is sure to make the animal's mouth sore. The mule's mouth is a very difficult part to heal, and once it gets sore he becomes unfit for work. Your bridle should be fitted well to the mule's head before you attempt to work him in it. Leave your bearing line slack, so as to allow the mule the privilege of learning to walk easy with harness on. It is too frequently the case, that the eyes of mules that are worked in the

Government service are injured by the blinds being allowed to work too close to the eyes. This is caused by the blind-stay being too tight, or perhaps not split far enough up between the eyes and ears. This stay should always be split high enough up to allow the blinds to stand at least one inch and a-half from the eye.

"Another, and even more essential part of the harness is the collar. More mules are maimed and even ruined altogether by improperly fitting collars, than is generally believed by quartermasters. It requires more judgment to fit a collar properly on a mule than it does to fit any other part of the harness. Get your collar long enough to buckle the strap close up to the last hole. Then examine the bottom, and see that there be room enough between the mule's neck or windpipe to lay your open hand in easily. This will leave a space between the collar and the mule's neck of nearly two inches. Aside from the creased neck, mules' necks are nearly all alike in shape. They, indeed, vary as little in neck as they do in feet; and what I say on the collar will apply to them all. The teamster has always the means in his own hands of remedying a bad fitting collar. If the animal does not work easy in it, if it pinch him somewhere, let it remain in water over night, put it on the animal wet, the next morning, and in a few minutes it will take the exact formation of the animal's neck. See it properly fitted above and below to the hames, then the impression which the collar takes in a natural form will be superior to the best mechanical skill of the best harness-maker.

"There is another thing about collars which, in my opinion, is very important. When you are pursuing a journey with teams of mules, where hay and grain are scarce, the animals naturally become poor, and their necks get thin and small. If once the collar becomes too large, and you have no way of exchanging it for a smaller one, of course you must do the next best thing you can. Now, first take the collar off the animal, lay it on a level, and cut about one inch out of the centre. When you have done this, try it on the animal again; and if it still continues too large, take a little more from each side of the centre until you get it right. In this way you can effect the remedy you need.

"In performing a long journey, the animal will, if driven hard, soon show you where the collar ought to be cut. They generally get sore on the outer part of the shoulder, and this on account of the muscle wasting away. Teamsters on the plains and in the Western Territories cut all the collars when starting on a trip. It takes less time afterwards to fit them to the teams, and to harness and unharness.

"When you find out where the collar has injured the shoulder, cut it and take out enough of the stuffing to prevent the leather from touching the sore. In this way the animal will soon get sound-shouldered again. Let the part of the leather you cut hang loose, so that when you take the stuffing out you may put it back and prevent any more than is actually necessary from coming out.

"See that your hames fit well, for they are a matter of great importance in a mule's drawing. Unless your hames fit your collar well, you are sure to have trouble with your harness, and your mule will work badly. Some persons think, because a mule can be accustomed to work with almost anything for a harness, that money is saved in letting him do it. This is a great mistake. You serve the best economy when you harness him well, and make his working comfortable. Indeed, a mule can no more work with a bad fitting collar and harness than a man can walk with a bad fitting boot. Try your hames on, and draw them tight enough at the top of the mule's neck, so that they will not work or roll round. They should be tight enough to fit well without pinching the neck or shoulder, and, in fine, fit as neatly as a man's shirt collar.

"Do not get the bulge part of your collar down too low. If you do, you interfere with the machinery that propels the mule's fore legs. Again, if you raise it too high, you at once interfere with his wind. There is an exact place for the bulge of the collar, and it is on the point of the mule's shoulder. Some persons use a pad made of sheepskin on the top of the collar. Take it off, for it does no good, and get a piece of thick leather, free from wrinkles, ten or twelve inches long, and seven wide; slit it crosswise an inch or so from each end, leaving about an inch in the centre. Fit this in, in place of the pad of sheepskin, and you will have a cheaper, more durable, and cooler neck-gear for the animal. You cannot keep a mule's neck in good condition with heating and quilted pads. The same is true of padded saddles. I have perhaps ridden as much as any other man in the service, of my age, and yet I never could keep a horse's back in good condition with a padded saddle when I rode over twenty-five or thirty miles a day.

"There is another evil which ought to be remedied. I refer now to the throat-latch. Hundreds of mules are in a measure ruined by allowing the throat-latch to be worked too-tight. A tight throat-latch invariably makes his head sore. Besides, it interferes with a part which, if it were not for, you would not have the mule—his wind. I have frequently known mules' heads so injured by the throat-latch that they would not allow you to bridle them, or indeed touch their heads. And to bridle a mule with a sore head requires a little more patience than nature generally supplies man with.

"Let a mules' ears alone. It is very common with teamsters and others, when they want to harness mules, to catch them by the ears, put twitches on their ears. Even blacksmiths, who certainly ought to know better, are in the habit of putting tongs and twitches in their ears when they shoe them. Now, against all these barbarous and inhuman practices, I here, in the name of humanity, enter my protest. The animal becomes almost worthless by the injuries caused by such practices. There are extreme cases in which the twitch may be resorted to, but it should in all cases be applied to the nose, and only then when all milder means have failed.

"But there is another, and much better, method of handling and overcoming the vices of refractory mules. I refer to the lariat. Throw the noose over the head of the unruly mule, then draw him carefully up to a waggon, as if for the purpose of bridling him. In case he is extremely hard to bridle, or vicious, throw an additional lariat or rope over his head, fixing it precisely as represented in the drawing.* By this method you can hold any mule. But even this method had better be avoided unless where it is absolutely necessary.

"It is now August, 1866. We are working 558 animals, from 6 o'clock in the morning until 7 o'clock at night, and out of this number we have not got ten sore or galled animals. The reason is, because we do not use a single padded saddle or collar. Also, that the part of the harness that the heavier strain comes on is kept as smooth and pliable as possible for it to be. Look well to your drawing-chains, too, and see that they are kept of an even length. If your collar gets gummy or dirty, don't scrape it with a knife; wash it, and preserve the smooth surface. Your breeching, or wheel-harness, is also another very important part; see that it does not cut and chafe the animal so as to wear the hair off, or injure the skin. If you get this too tight, it is impossible for the animal to stretch out and walk free. Besides obstructing the animal's gait, however, the straps will hold the collar and hames so tight to his shoulder, as to make him sore on the top of his neck. These straps should always be slack enough to allow the mule perfect freedom when at his best walk."

APPENDIX VI.

PRECIS OF THE TRANSPORT CARRIAGES USED DURING THE ZULU WAR FROM REPORTS RENDERED BY OFFICERS EMPLOYED IN THE TRANSPORT IN ZULULAND AND THE TRANSVAAL, WITH DRAWINGS OF AN AMERICAN WAGON, AN AMERICAN BUCK-WAGON, AND A SCOTCH CART USED DURING THE ZULU WAR, AND SENT HOME AFTER ITS CONCLUSION.*

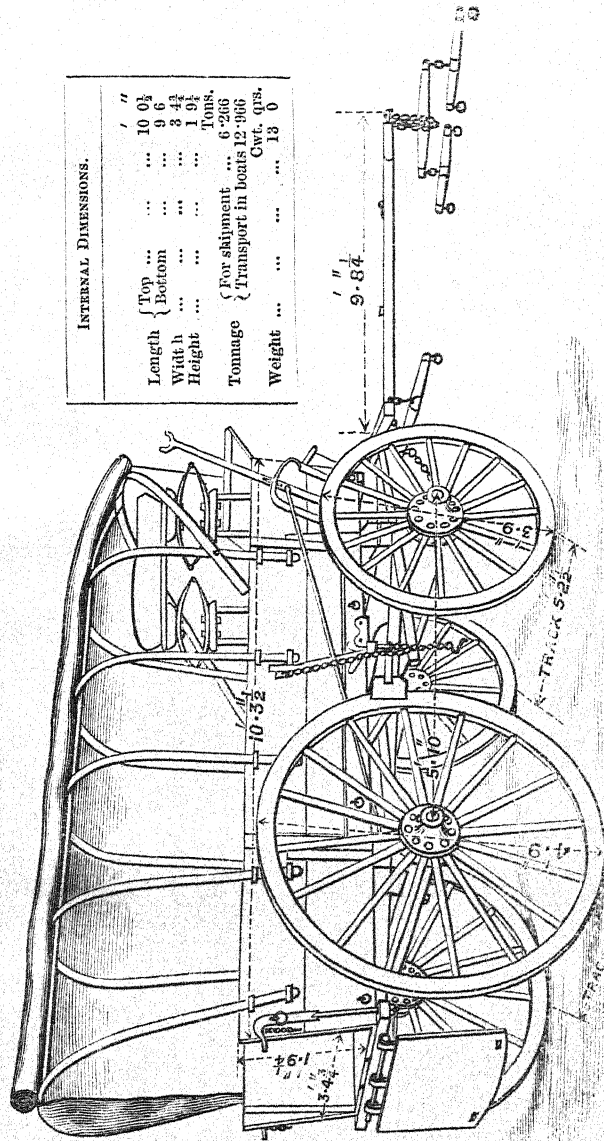
In the month of July, 1879, over 1,500 wagons were employed as army transport in connection with the British forces engaged in the Zulu War. The wagons and carts used, drawn by oxen and mules, were of many descriptions, but may be reduced principally to four, viz.: the English-built General Service Wagon the South African and North American wagons, of several patterns, differing both in size and weight; and the Scotch cart.

The *General Service Wagon* (of which there were about 186) was not found well adapted for Service in South Africa, it proved too heavy and cumbersome. Its average weight is 17 cwt., and with six horses, or eight large mules, or ten or twelve small ones, it conveyed a load of 15 cwt. on bad, and 20 cwt. on good roads. This wagon is expensive, and is essentially a wagon for good macadamised roads, for the carriage of compact stores. It was spoken of as too rigid, difficult to load and unload, and easily upset where transport had to be done on rough roads; those constructed on the equirota system were preferred to the lock-under ones, as the facility of turning in a limited space was not of much account in such an open country, and the fore wheels of the latter were too small for moving on soft ground. The wheels of the General Service Wagon are too close together, and this construction, though it undoubtedly lightens the draught on good roads, made the wagon ill-adapted for rough travelling when moving over uneven ground, hollows, and the like. The low fore wheels made it also difficult to repair when damaged; it held too little in comparison with the draught, and could not carry the same volume of freight as the country wagon, or the American buck-wagon, to both of which it was found decidedly inferior for ordinary rough and cross-country work. In the matter of cost it is also behind these, as it costs as much as three or four American wagons.

The *South African Wagons* were of several patterns, varying both in size and weight. In Natal, wagons of good medium size are made for work, those from the Cape and the Transvaal are heavier and clumsier. A South African Wagon about 20 feet long, and about 25 cwt. in weight, is very suitable to the country; of these there were three kinds—(a) tented the whole length; (b) half-tented; (c) the so-called buck-wagon, with sail-cloth covering, more generally used. Wagons not exceeding 18 to 20 feet in length were considered superior to longer wagons, and the tented ones often proved troublesome when passing through a wooded country. The ordinary load in the transport of the country is from 65 to 80 cwt., and on bad roads not more than 60 cwt. A colonist wagon, with a good team of oxen, will take a load

* Drawings of the several army wagons in use will be found in the "Regulations for the Supply of Stores to an Army in the Field," and in "Treatise on Military Carriages."

THE AMERICAN WAGON.

Scale about $\frac{1}{2}$ rd.

INTERNAL DIMENSIONS.			
Length	{ Top ...	10 0 $\frac{1}{2}$	' "
	{ Bottom ...	9 6	
Width	h ...	3 4 $\frac{1}{2}$	
Height	... ..	1 9 $\frac{1}{2}$	Tons.
Tonnage	{ For shipment ...	6 266	
	{ Transport in boats ...	12 966	
Weight	... ..	13 0	Cwt. qrs.

of 40 cwt. anywhere. For field work on bad roads and tracks, not more than 30 to 45 cwt. were carried, often only 25 cwt. The ordinary Natal ox-wagon was found best suited to stand the wear and tear on the South African roads. Though an ordinary load for such a wagon in time of peace averages 7,000 lbs., the carriers of the country put on it, at times, as much as 8,000 to 9,000 lbs. During the war, the maximum weight of load for an ox-wagon was fixed at 4,000 lbs., and for a wagon of the colonial pattern, drawn by ten mules, 3,000 lbs. was considered a fair load.

The weight carried, or load, must be reduced when a large number of wagons move together, when the work of the transport is continuous, and when the convenience of marching, instead of depending on the will of the owner, has to be guided by military necessities. The bad roads in this war often reduced the weight carried by one half.

American Wagons of different patterns, large and small, were used. The American buck-wagon weighs about 17 cwt., and with twelve mules carries a load of 20 cwt. on bad roads, and 25 cwt. on good roads. The large American can carry three tons over good, and one and a half tons over bad roads; the latter was considered to be too heavy for mules, and not sufficiently strong for oxen. The small American buck-wagon, long, low, and broad, with wheels rather far apart, is about the best mule-wagon; it is strong, cheap, easily repaired, convenient to load, and difficult to upset. For mule-draught this sort was recommended to be exclusively used, it weighs about 13 cwt., and with ten mules would carry about the same weight of load as the larger American wagon. With a span of twelve mules it will carry a load of from 3,000 to 5,000 lbs. These wagons were found very serviceable and handy, being reported as just the article needed for flying columns moving either on good or bad roads. Short wagons, with short teams (say eight mules) were found preferable to long wagons with long teams. A few wagons, approaching the United States Army pattern, were reported excellent for field work. their high fore-wheels enabling them to travel well on rough ground, American wagons, on good roads, can carry up to 5,000 lbs., but on bad roads 2,500 lbs. was considered a proper load. They are difficult to turn in a small space, and also too low for crossing water, exposing the articles carried to the risk of being damaged.

Scotch Carts, ox and mule, were found useful for light loads on very bad roads; they were principally used for medical carts, entrenching tools, small arm ammunition reserve, and Staff Officers' baggage, and moved small loads over the worst roads with comparative celerity. Two-wheel Scotch carts were esteemed the best vehicles to accompany the troops in the field, being well suited for rough work and rapid movements.

These vehicles are handier and quicker to work than wagons, much lighter, and less liable to accidents, and being strongly-built, can go anywhere, and can keep up with the troops. In Scotch carts a difficult point is the adjustment of the load so that the balance of the pole upon the wheelers may be preserved; scarcely carrying from one-third to one-fourth of the load of larger wagons, they also extend the length of the train on the march, requiring besides as many men to work them as the latter. They are very useful with spans of either oxen or mules; with spans of six oxen, they draw easily a load of 1,000 lbs., and with four mules, a load of 800 lbs. on bad, and 1,000 lbs. on good roads.

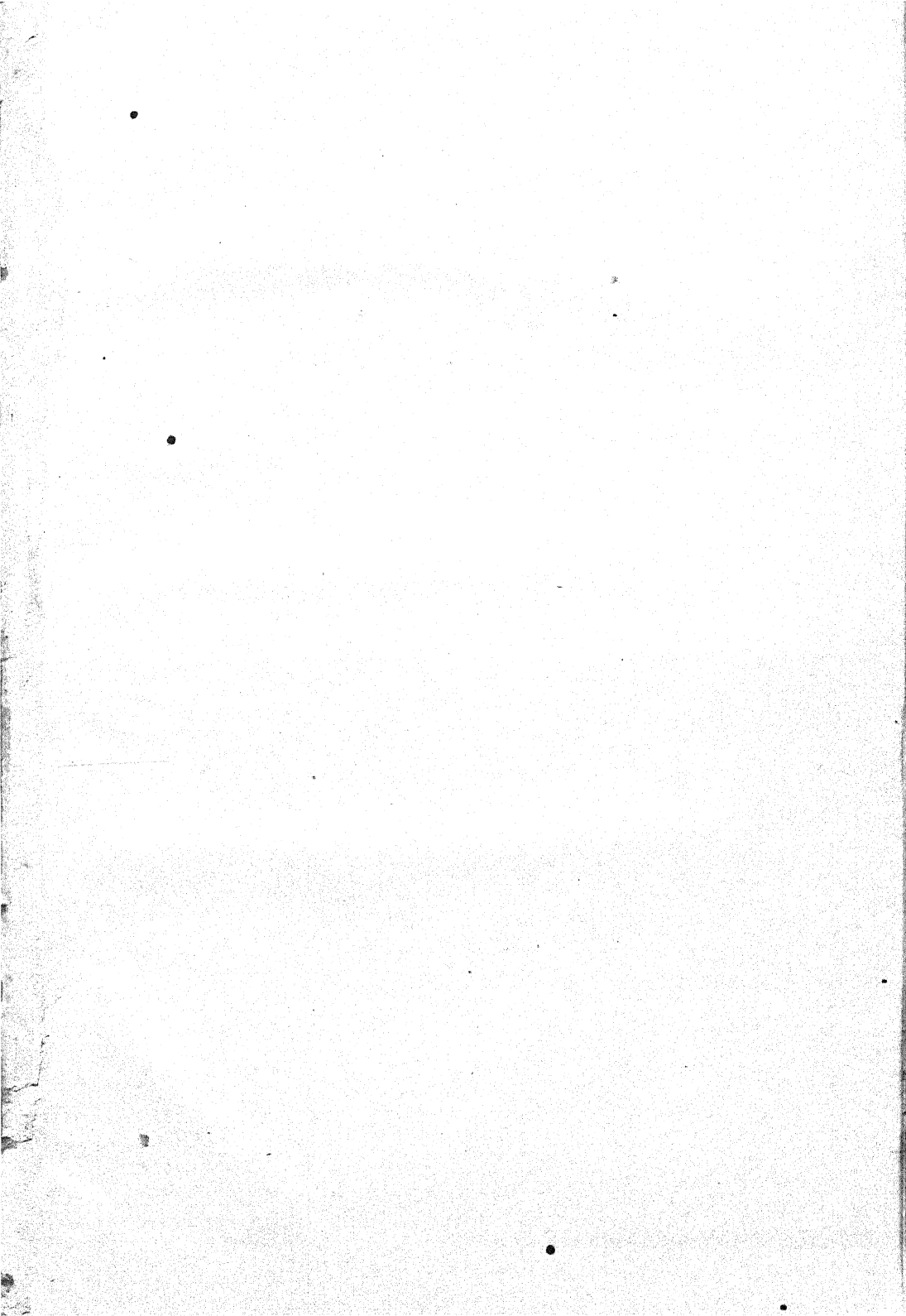
The experience of the Zulu War showed that the General Service Wagon was not as popular with Transport Officers as the South African, or American wagons; there was here a repetition of the expressions of the French officers during the Mexican War (see "*Les Méthodes de Guerre*," par le Lieut.-Colonel Pierron, page 1363) and of

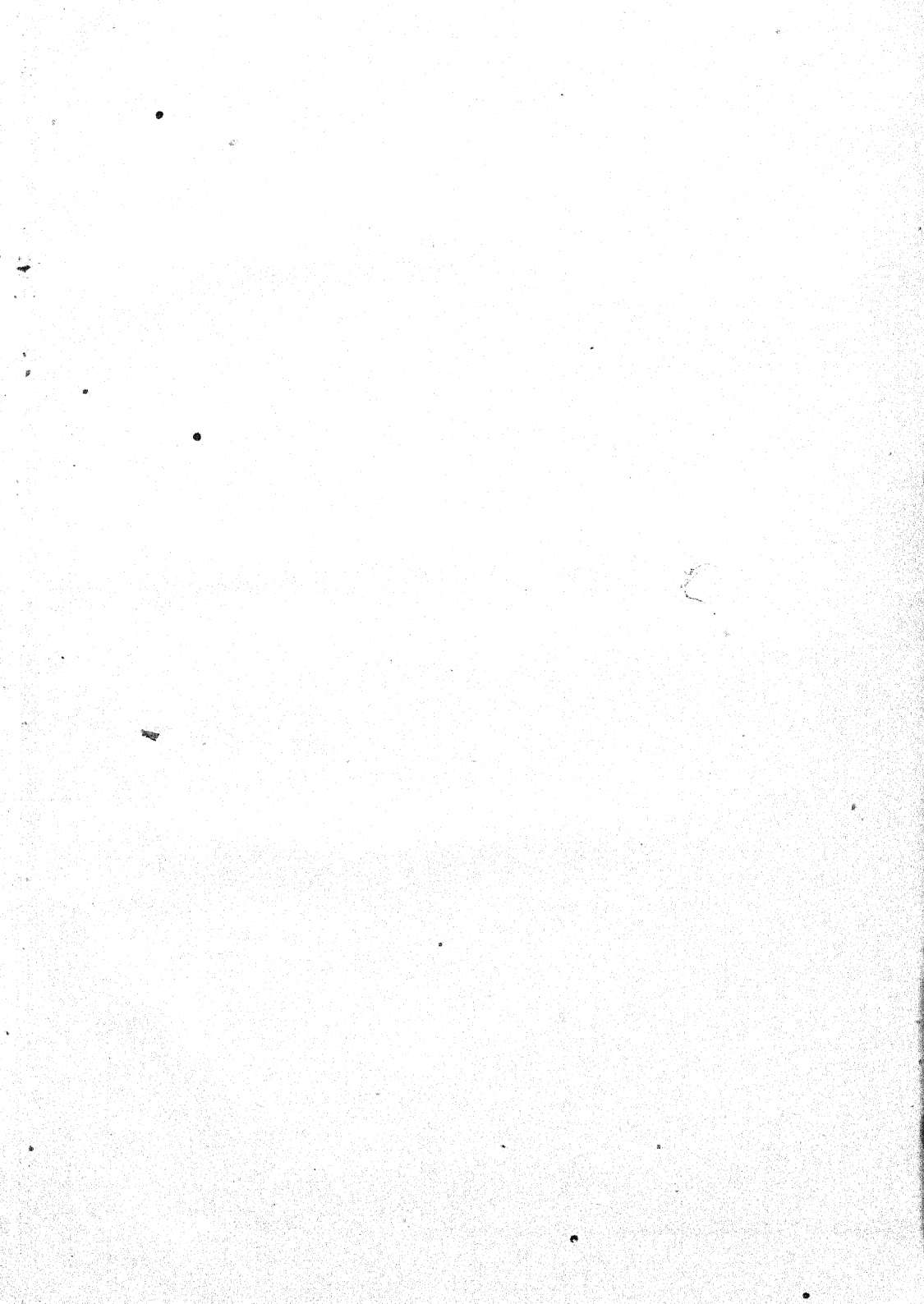
the officers of the United States army in favour of the American Army wagon. The statement of the Quartermaster-General of the United States Army, in his report dated Washington, 8th November, 1865, furnished at the conclusion of the Secession War, that "the carriages . . . of the United States Army were hardly susceptible of any further improvement," coming from a very practical nation, deserves consideration, and by General Sherman's showing, the roads on which these wagons moved were not of the best. Of the American army pattern wagon we have also the following testimony by Mr. Riley: "At the end of the war, it was shown that the army pattern wagon had been worked more, had been repaired less, and was in better condition than any other wagon used. I refer now to those made in Philadelphia by Wilson and Childs, or Wilson, Childs, and Co. They are known as the "Wilson Wagon." General Sherman gives the load for such a wagon at 3,000 lbs., carrying, where beef cattle are driven, rations for two days for 1,000 men.

The American buck-wagon, which was highly spoken of, and recommended for use in future wars, has the following advantages over the General Service Wagon. It has greater capacity; owing to its great length and wide outspreading raves, it is better adapted for the conveyance of bulky loads, and it is said that it will carry twice, and even three times as much; it costs one third less, and not being rigidly connected with the wheels, it has a certain amount of elasticity, which saves the various parts from being overstrained. The iron-work which has been objected to as having a rough and weak appearance, besides having stood the test of heavy work during the Zulu War, is of such a nature as to be easily replaced or repaired by ordinary military artificers, an important consideration on service. The drawbacks of this wagon, when compared to the General Service Wagon, are that it is more difficult to pack on board ship, requires, owing to its small angle of lock, much more room to turn in, and is not so good for storage. The question of storage can be set aside, as the point is, not to ascertain the best wagon for peace time, but for war. The turning in a space almost equal to its own length, of the General Service Wagon, is no doubt, an important point in an enclosed country like England, but the lock-under principle by which this is obtained, adds greatly to the rigidity of the wagon, and makes it unsuitable for work over ordinary roads.

We cannot expect to get a perfect wagon, if we find one which has stood the test of war and possesses a number of important advantages over other descriptions of carriages, we must naturally declare in favour of it, to the exclusion of other patterns. It is very doubtful if in an enclosed country like ours, with good macadamized roads, the American wagon can ever receive a fair trial when compared with the General Service Wagon, which is admitted to be very suitable for a country of this description; when the two have been tested together on service, the advantages of the latter over the first have been found so great as to leave no doubt in the minds of the officers who have seen both at work that, of the two, it is a better and more desirable description of wagon for service.

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